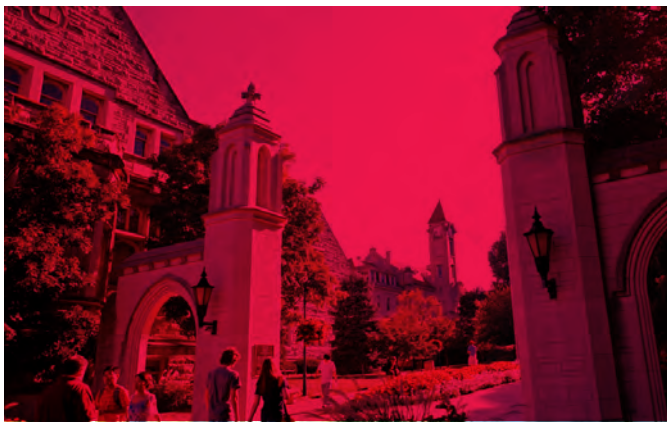
INDIANA UNIVERSITY

GRAND CHALLENGES




MAKING LIFE BETTER FOR HOOSIERS EVERYWHERE





THE VISION FOR IU GRAND CHALLENGE INITIATIVES

When the Indiana University Board of Trustees approved the Bicentennial Strategic Plan for Indiana University that called for the Grand Challenges program, we knew it was a bold vision to guide the university as we began our third century.

For the first time in our 200-year history, the Grand Challenges program strategically harnessed the university's intellectual and financial resources in partnership with our state, business and nonprofit leaders to advance solutions to critical problems facing Hoosiers and beyond. Little could we know how impactful that decision would be. The world has changed in big ways this past year. The focused pursuit of the Grand Challenges meant experts were poised to pivot quickly in collaboration with our partners when the pandemic struck. Having demonstrated a greater ability for IU to meet evolving and growing needs, the Grand Challenges are clearly more important now than ever.

As a medical professional and proud alumnus of Indiana University's School of Medicine, the Precision Health Initiative (PHI) is especially important to me. The goal of precision medicine is to get the right treatment to the right patient at the right time. PHI is working to prevent and treat diseases Hoosiers are facing, such as hard-to-treat cancers, Type 2 diabetes and Alzheimer's disease, making those advanced treatment methods available right here in Indiana.

I am forever grateful to President Michael A. McRobbie. While his achievements are too many to enumerate here, it was under his leadership that our university community established new collaborations to implement these initiatives. The real winners are those whose lives have been enhanced by this critical work, and President McRobbie's vision has strengthened IU's standing as one of the world's great research institutions, laying the foundation for continued progress to further advance the human condition.

Michael J. Mirro, M.D.

Chair, Board of Trustees

Indiana University President Michael A. McRobbie and Indiana Governor Eric J. Holcomb

Three years ago, I was honored to partner with Indiana University to announce the third Grand Challenge initiative, Responding to the Addictions Crisis. At that time, I said:

> **"From education and training to data collection and analysis to community and workforce development, Indiana University's Grand Challenge is going to go such a long way to help turn the tide against this crisis of addiction. We're going to beat this thing together. I just know it."**

Three years later, these efforts are changing lives. As we work to decrease opioid overdose deaths and reduce the number of babies born with Neonatal Abstinence Syndrome, the Addictions Grand Challenge is one of the largest and most comprehensive state-based responses to the crisis.

As governor, I'm laser-focused on busting barriers and empowering Hoosiers in every community and corner of our state. That's the crux of the Grand Challenges and why they are so impactful. They're taking on tough work and solving important problems.

It's not an easy task, so I couldn't be more grateful to IU President Michael A. McRobbie for his visionary leadership, trust and partnership with the state of Indiana. Together, we're tackling the most important problems facing Indiana. And together we will solve these problems and make our state, nation and world a brighter place.

Eric J. Holcomb

Governor of Indiana

OUR GRAND CHALLENGES

When announcing Indiana University's Grand Challenge initiatives, President McRobbie said that they would be "few, large, focused and measured by their impact." The goal was to marshal the combined resources of the entire university and our many partners to address issues of global importance right here in Indiana. In the pages that follow, you can read more about our three initiatives and their impact to date, a little more than halfway through the Grand Challenges program.

None of the achievements described would have been possible without the vision of President McRobbie and our Trustees; the skill and dedication of hundreds of faculty, staff and students; and the steadfast partnership of Governor Holcomb and many other partners throughout Indiana. I am grateful for their public-spirited commitment and support.

Read on to see the difference that your vision, hard work and collaboration are making to our state and nation, in local communities, in farms and factories and in the lives of our fellow Hoosiers.

Fred H. Cate

Vice President for Research

Precision Health Initiative

Chronic illnesses like cancer, diabetes and Alzheimer's disease touch the lives of countless Hoosiers every year. Alleviating the burden of these conditions can dramatically improve the quality of life for those suffering across Indiana and help steward the state's health care resources. IU's Precision Health Initiative — launched in 2016 — aims to provide individualized, targeted treatments developed through the rigorous research of genetic, developmental and environmental factors that influence health at a personal level. Precision Health is the future of health care and at IU the future is now.

Prepared for Environmental Change

As environmental factors change and evolve, Hoosiers face wide-ranging consequences that will affect our state's economy and the health of our communities. Launched in early 2017, the Prepared for Environmental Change Grand Challenge reflects IU's commitment to help Hoosiers adapt and thrive amid these changes. A broad, bipartisan coalition of researchers, government and business leaders, and nonprofit and community organizations have joined together to provide tools and resources to ensure Indiana is prepared to address environmental challenges that are impacting the way we live, grow food and conduct business.

Responding to the Addictions Crisis

Launched in 2017, the Responding to the Addictions Crisis Grand Challenge seeks to curtail the prevalence of substance use disorder across Indiana, decrease opioid overdose deaths and reduce the number of babies born with neonatal abstinence syndrome. Today a total of 32 research teams are leading work focused on combating stigma; developing and deploying new treatment and training options; prevention and harm reduction; law and policy; and the economic impact of the addictions crisis and its effect on our workforce. Comprising various partners, this initiative is one of the nation's most comprehensive state-based responses to the addiction crisis and the largest led by any university.

10,000+
Hoosier Donors

Thousands of Hoosiers have donated their blood, DNA and bone marrow to the Indiana Biobank, participating in valuable research.

6 Clinical Health Goals

The Precision Health Initiative is finding new ways to prevent Type 2 diabetes and Alzheimer's, and discovering cures for pediatric sarcomas, multiple myeloma, triple negative breast cancer and undiagnosed and rare diseases.

"At IU, I feel like we do an exceptional job of crossing the divide between basic science and clinical research."

—MILAN RADOVICH, PHD, CO-DIRECTOR OF THE IU HEALTH PRECISION GENOMICS PROGRAM

LEADING THE WAY ON PRECISION HEALTH

IU's first Grand Challenge, the Precision Health Initiative, has worked to prevent and treat diseases like Alzheimer's, diabetes and childhood and adult cancers. With active health initiatives in 68 Indiana counties, IU is working with Hoosiers and making discoveries that are improving lives.

When COVID-19 hit, IU Precision Health Initiative (PHI) physicians and scientists quickly pivoted to make the pandemic their priority, collecting blood samples from those exposed and not exposed to spur further research and implement prevention strategies.

Instead of giving up on their pursuit of treatments and cures for some of the most dreaded diseases facing Hoosiers, they also adapted their consent forms to allow for virtual visits, which allowed research, discoveries and vital progress to continue.

This includes the work of Indiana's first Undiagnosed and Rare Disease Clinic (URDC), launched by PHI in January of 2020, to take a look at the genetics that may be causing diseases impacting Indiana children for whom a diagnosis has remained elusive. The clinic has already found answers for Hoosiers like Jordan Edwards and her parents. Edwards suffers from a rare genetic disorder impacting her ability to eat and gain weight.

Additionally, PHI researchers discovered an emerging drug combination that halted the growth of tumor cells donated by the late research advocate Tyler Trent.

Battling Triple Negative Breast Cancer

PHI researchers have discovered and developed a promising combination drug therapy for triple negative breast cancer. Milan Radovich, PhD, and his colleagues tested a combination of two drugs as part of an initial safety study for triple negative breast cancer patients. It is one of the most aggressive forms of the disease, with fewer approved treatment options than any other type of breast cancer.

This study was inspired in part by the classic game "Whac-A-Mole." Even if a player can accurately hit a disease target (the mole), another one often pops up in a different spot. Preclinical work found this to happen when treating triple negative breast cancers. Scientists would focus treatment on a specific genomic abnormality commonly seen in triple negative breast cancer, only to have the cancer rapidly compensate by activating another pro-cancer target.

"Our goal has always been that anything we do has to have an end-point that focuses on the patient, where the patient will benefit," said Radovich, who co-leads the IU Precision Health Initiative triple negative breast cancer disease research team. "At IU, I feel like we do an exceptional job of crossing the divide between basic science and clinical research, and this is just another example of that."

> **"To know that there is hope, and that things are continuing to progress gives folks that have a pretty scary diagnosis a good chance and a positive chance."**
>
> —ANGIE STEENO, IU PATIENT AND TRIPLE NEGATIVE BREAST CANCER SURVIVOR

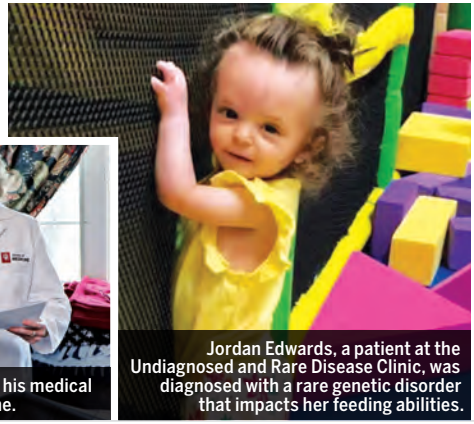
Tyler Trent's Legacy

Researchers at Indiana University School of Medicine have developed a combination therapy that significantly slows tumor growth in models. This includes a model established from cells taken from tumors donated by Tyler Trent. Published in the peer-reviewed international oncology journal *Cancers*, this is the first published manuscript that includes Trent's tumor model.

"This research is allowing us to forge a path to improving outcomes for children, adolescents and young adults with a very aggressive bone cancer," said Jamie Renbarger, MD. Renbarger was one of Tyler's doctors and also leads the IU Precision Health Initiative pediatric sarcoma disease research team.

Trent was a Purdue University student and sports superfan who died on January 1, 2019, after waging a long and valiant fight against an aggressive form of bone cancer known as osteosarcoma. The IU researchers dedicated the study to Trent's memory, saying they will always remember him for his courageous battle, his passion for cancer advocacy and the generous donation of his tumor tissue for research.

Tyler Trent, who battled osteosarcoma, with members of his medical team, including physicians from the IU School of Medicine.



Jordan Edwards, a patient at the Undiagnosed and Rare Disease Clinic, was diagnosed with a rare genetic disorder that impacts her feeding abilities.

Diagnosing Rare Diseases

The Undiagnosed and Rare Disease Clinic (URDC) launched in January 2020 has already seen success. PHI researchers affiliated with the clinic help patients who may have genetically based rare diseases, when other doctors have not been able to determine a diagnosis.

"The URDC is there as a resource for families who are still on the hunt for answers," said Erin Conboy, MD. "We're not going to give up. We're going to keep looking, if it takes discovering a new gene to be able to diagnose your child, we're going to try to do that."

One of the clinic's first patients was Jordan Edwards, a young girl who was having trouble eating and was barely gaining any weight. The URDC team performed genetic testing on each member of her family, and discovered Jordan has a rare genetic disorder that impacts her feeding abilities.

"It's very important because I believe parents deserve to know what's going on with their children," said Desiree Edwards, Jordan's mother. "The URDC helped us understand what she's going through and what the genetic disorder is."

Finding a Cure for Multiple Myeloma

The Precision Health Initiative (PHI) multiple myeloma disease research team

is working toward a cure for multiple myeloma, a type of blood cancer.

"We believe that there is an opportunity to design a precision CAR-T cell therapy," said Fabiana Perna, MD, PhD. "One therapy may not fit all patients, but we want to design a therapeutic platform that takes into consideration the genetic background of patients and thus is more effective for specific subsets of patients."

Perna says CAR-T cell therapy is one of the breakthrough approaches to possibly cure multiple myeloma, but there are still several key questions that need to be addressed. PHI has two ongoing clinical studies available. Scientists are also asking patients to donate bone marrow samples to the Indiana Biobank and have collected genetic material from more than 400 Hoosiers.

"Being able to study patient samples through the collection of these precious materials in the Biobank is critical for many research questions and also to validate our discoveries," said Perna.

Researchers say they're determined to look for the best personalized approaches to prolong patient life expectancy and quality of life in Indiana and across the country.

Finding Answers for Alzheimer's

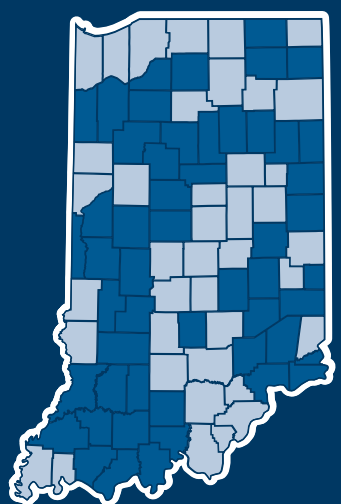
Alzheimer's disease impacts thousands of Hoosiers and their loved ones each year. It remains a large burden on individuals and their caregivers, but also the greater Indiana health care system. The Precision Health Initiative is conducting valuable research to help diagnose and treat the progression of Alzheimer's.

Researchers are studying how the body's own immune system may impact the underlying biology associated with cognitive decline, the primary symptom of Alzheimer's disease. The team is working to establish new immune biomarkers associated with Alzheimer's disease that, together with existing Alzheimer's biomarkers, will help better predict onset and progression. Once these are determined, researchers will investigate and develop immune-based therapies that not only positively influence biomarkers of the disease, but that are also tailored precisely to an individual's own biology.

> **"Any tough scientific problem can be intimidating, but if you have exceptional colleagues, strong plans and investments, and an environment like this, you can chip away at the challenge and little by little, make progress."**
>
> —ALAN PALKOWITZ, PHD,
> IU SCHOOL OF MEDICINE-PURDUE UNIVERSITY
> SENIOR RESEARCH PROFESSOR OF MEDICINE

68 Indiana Counties

Precision health research and clinical care is being conducted across the state, with active efforts in 68 counties focused on Type 2 diabetes, Alzheimer's disease and various types of cancer.



30 local governments

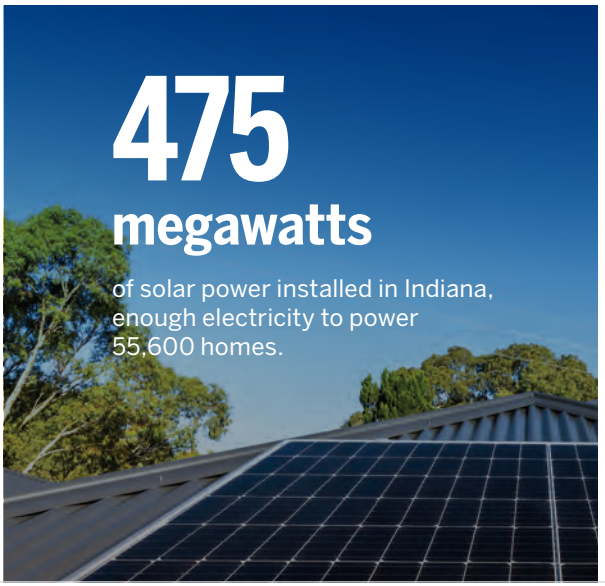
participating in the Hoosier Resilience Cohort Program.

"As farmers, we have control over a lot of things but one of the things we don't have control over is the weather. There is a niche for an organization like ERI to step in and start really helping us understand the science behind what we're doing."

— DAN DESUTTER, OWNER AND OPERATOR OF DESUTTER FARMS, FOUNTAIN COUNTY

69%

of Hoosiers believe **climate change will harm Indiana** residents.



475

megawatts

of solar power installed in Indiana, enough electricity to power 55,600 homes.

PREPARED FOR ENVIRONMENTAL CHANGE

In 2017, IU launched its second Grand Challenge to build state-specific projections of environmental change, helping state leaders create strategic investments in agriculture, industry, infrastructure and public health for all Hoosiers.

The Prepared for Environmental Change Grand Challenge consists of hundreds of scientists, government and business leaders, students and faculty committed to strengthening Indiana's resilience in the face of environmental challenges. The coalition collaborates to create accessible resources to engage local leaders and residents and conduct research to inform these initiatives and more.

As part of the Grand Challenge, IU's Environmental Resilience Institute (ERI) works to prepare businesses, families and communities to adapt and thrive. This includes projection modeling of risks related to climate and ecosystems, finding ways to communicate these risks to the public, developing wildlife and natural resource conservation strategies, and advising government and business leaders on decisions that affect everyday Hoosiers.

Helping Hoosiers Thrive

Solutions to environmental changes cannot be one-size-fits-all. Instead, they must be region-specific and guided by data and collaboration. Delivering solutions requires a critical understanding of how to communicate the impacts of environmental change while making tools and resources easily accessible to the public.

Tools developed through the Grand Challenge — like FutureWater and the Hoosier Resilience Index — are increasing resilience to environmental change in Indiana and the Midwest by accurately predicting impacts and effectively partnering with communities to implement feasible, equitable and research-informed decisions. With necessary and accurate information from the scientific community about the inequitably experienced risks and adverse impacts of climate change, communities can reduce, respond to and recover from those impacts.

Janet McCabe has served as director of IU's Environmental Resilience Institute since 2019. On January 15, 2021, she was nominated by then President-Elect Biden to serve as deputy administrator of the U.S. Environmental Protection Agency.

A multi-use trail for cyclists and pedestrians in Richmond, Ind. Richmond has been a participant in IU's Resilience Cohort.

The Hoosier Life Survey

The Hoosier Life Survey (HLS), conducted by ERI, is one of the most comprehensive statewide public-opinion surveys of environmental change to date. The survey offers Indiana-specific insights on public attitudes toward environmental change, personal values, trust in the news media and attitudes toward a variety of kinds of risks.

In total, more than 2,700 Hoosiers, representing 90 of the state's 92 counties, have responded. Taken together, respondents' answers show what Hoosiers think about environmental change, its origins, its extent and its impact on their families. The survey also indicates how Hoosiers learn about the issues vital to their future — who they trust, who they listen to and who they'd like to hear more from.

The HLS highlights how much Hoosiers are already doing, or are prepared to do, to build resilience against environmental change. And it reveals the role of political and personal values — along with social, demographic and economic differences — in shaping Hoosiers' approach to a global challenge.

Providing Resilience Resources for Local Governments

Addressing environmental change in Indiana requires collaboration from all corners of the state. Researchers at ERI engage local governments, researchers, educators and residents to bolster Indiana's preparedness.

IU partners with local governments through ERI to better understand how climate change is affecting towns, cities and counties. By combining this knowledge with IU research, ERI can help local officials address environmental challenges by providing tools, resources and useful information.

Through its Resilience Cohort Program, ERI leads local governments through the process of measuring, managing and tracking greenhouse gas emissions. Participants join a cohort of peers and each jurisdiction receives one-on-one guidance, attends cohort training webinars, gains the opportunity to apply for additional staff capacity by hosting a summer intern and more.

More than 30 local governments will be participating in the Resilience Cohort program in 2021. Since its inception in 2019, the program has contributed to 24 localized greenhouse gas inventories and 11 climate action plans.

Informing Indiana Decision Makers

The Environmental Resilience Institute Toolkit (ERIT) helps local governments prepare for environmental change by providing information tailored to their communities. Decision-makers can

create an integrated information package relevant to their needs. ERIT has a special emphasis on Midwestern communities and on small to mid-sized communities in both rural and urban areas.

Local governments also have access to the Hoosier Resilience Index, an interactive tool that presents risks specific to communities and offers assistance in making decisions leading to greater resilience. Other resources include the Climate Initiative Value Calculation (CIVIC) Workbook, Indiana-specific resources on renewable energy development, the Prepared for Environmental Change Webinar Series, fact sheets and data resources.

Considering Long-Term Risks

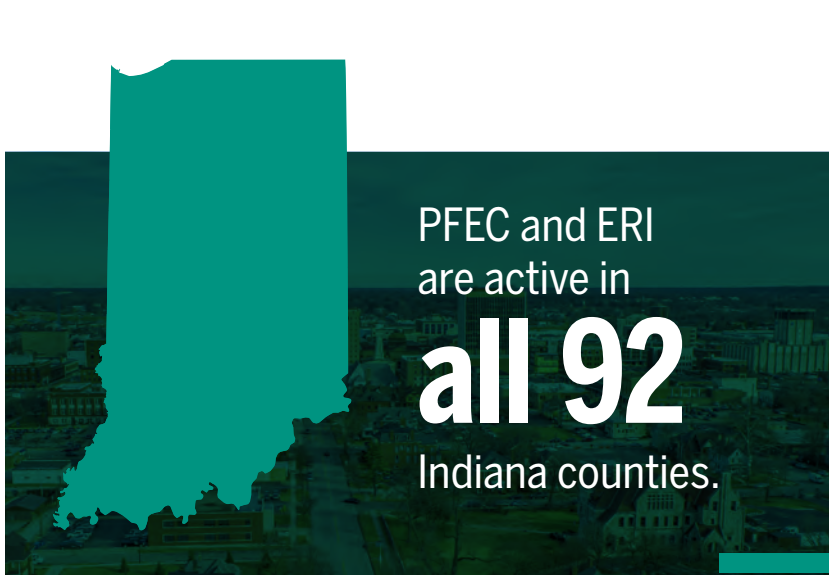
Since 2017, the Prepared for Environmental Change Grand Challenge and ERI have worked to address Indiana's most pressing environmental changes.

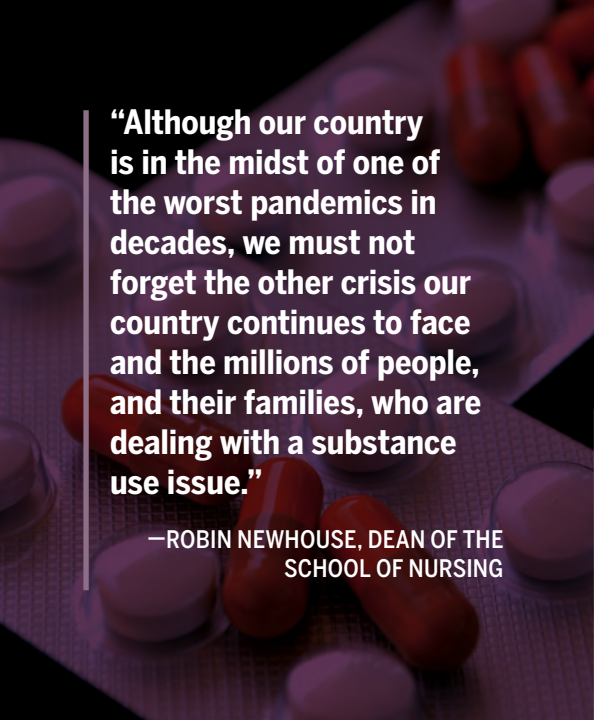
ERI has applied advanced computer technologies to predict surface water availability in the Wabash River Basin — which covers 60 percent of the state — through the end of the century under various climate change scenarios. This research will provide critical information for state leaders and local governments to best prepare for future climate scenarios that may have a sizeable impact on our economy and lifestyles.

"The data and educational resources being provided by the institute are critical new tools that local officials have never had before."

— MATT GRELLER, CEO OF ACCELERATE INDIANA MUNICIPALITIES

Researchers collected data from urban, suburban and exurban areas to assess the risk of tick- and mosquito-borne diseases and inform new approaches to counter this risk. As shown with the COVID-19 pandemic, understanding disease transmission and how it will be impacted by a changing climate is essential for protecting the health of Hoosiers.





"Although our country is in the midst of one of the worst pandemics in decades, we must not forget the other crisis our country continues to face and the millions of people, and their families, who are dealing with a substance use issue."

—ROBIN NEWHOUSE, DEAN OF THE SCHOOL OF NURSING

171+ at-risk Indiana students educated

IU researchers are partnering with community schools to provide a school-based therapy program for at-risk students.

160 partnerships throughout Indiana

with community organizations, treatment & recovery services, harm reduction organizations — and many others.

"The more we openly talk about substance use and get to know people with substance use issues on a deeper level, the closer we will get to reducing stigma around this issue."

—BREA PERRY, IU PROFESSOR OF SOCIOLOGY

RESPONDING TO THE ADDICTIONS CRISIS

At IU, we are leveraging the strengths of our campuses, the expertise of our faculty and the collaborative nature of our partners to confront addiction and substance use disorder where it matters most — in communities across our state.

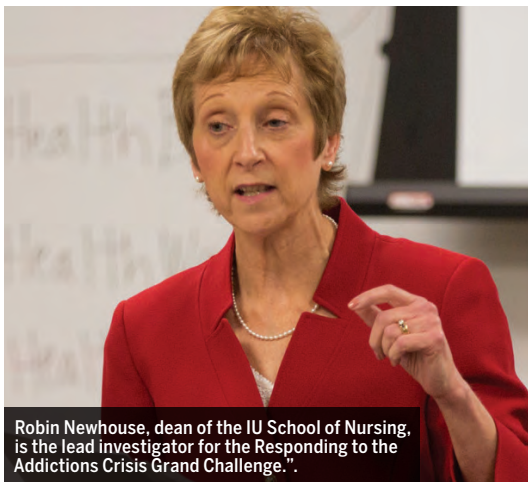
Amid the social and physical isolation inherent to a global pandemic, IU researchers have faced and persevered against new challenges and hurdles in their fight against the addictions crisis. In some cases the pandemic has worsened the scope of the addictions crisis.

In the last year, IU's Grand Challenge team has been able to pivot in real time to study the impact of COVID-19 on Hoosiers who are battling addiction, all while continuing initiatives established before the onset of the pandemic.

Through the Responding to the Addictions Crisis Grand Challenge, IU has trained hundreds of front-line workers, partnered with the Indiana criminal justice system to help teens find treatment, provided critical support for pregnant women and young mothers, coordinated with local high schools to engage at-risk students in school-based therapy, launched innovative training opportunities for mental health professions and targeted resources and services to meet evolving needs.

Training Front-Line Workers to Combat Stigma

In partnership with the School of Nursing, the Grand Challenge is offering two courses to help reduce stigma around substance use disorder. The online courses were made possible through a grant from the Commission for Higher Education of the State of Indiana. The courses are available to the public at no cost and are an extension of the Grand Challenge's *In This Together* project.



Robin Newhouse, dean of the IU School of Nursing, is the lead investigator for the Responding to the Addictions Crisis Grand Challenge.".

The first course, *In This Together: Community Conversations to Reduce Stigma of Substance Use Disorder*, fosters individual reflection and community discussions. The second course, *Substance Use Disorders: An Introduction for Nurses and Healthcare Professionals*, is aimed at nurses in Indiana and throughout the country and enhances participants' understanding of nursing practices related to substance use

disorders and addiction. These courses can be found online; those who complete the public course receive a certificate of completion and those who complete the nursing course earn continuing nursing education contact hours.

Leading the Way Together

To date, IU's response to the addictions crisis has included a robust network of more than 100+ business, nonprofit and government partners in 34 counties throughout the state who are addressing educational and training opportunities, prevention and treatment options, policy and law, and the economic impact of the addictions crisis. One such project is the CARE Plus project, which connects local pregnant women and young mothers who have substance use issues to community health workers and other resources.

The support network under CARE Plus has led to the hiring and training of eight community members as peer recovery coaches or addictions specialists. At least 185 women have enrolled to date. The coaches have remained busy during the pandemic, pivoting to safely provide services in accordance with CDC guidelines.

> **"It has been a very challenging time, but the CARE work, coaching and support is more needed now than even before COVID."**
>
> — DEBRA LITZELMAN, SENIOR RESEARCH SCIENTIST AT REGENSTRIEF INSTITUTE

Educating Indiana's At-Risk Youth

Expanding outside of the juvenile justice system, IU is also developing preventive measures to help adolescents who are at risk for using substances and developing substance use disorders. Through the Going 4 Goals project, the IU team has enrolled more than 160 Indianapolis area students in their school-based therapy program.

This nine-week, in-school program teaches teens how to deal with strong emotions and manage stress. Of those students enrolled in the program, 85% said the program affected their schooling in a positive way and almost all said it improved their communication with teachers and fellow classmates. Additionally, 55% of students said the program has positively affected their grades, teaching them valuable skills to

LaTasha Tmberlake, an Indianapolis community health worker, meets with a CARE Plus patient.

help them focus in class and prioritize their academics.

Increasing Public Policy Awareness

A large response to the opioid crisis in Indiana has come from the implementation and enforcement of policies and laws related to mental health and addiction, criminal justice, health care access, education, public safety and community engagement.

But those informing and sometimes implementing this response come from varying backgrounds, both professional — such as criminal justice, public health, law, non-governmental organizations, education and research — and personal. These varying perspectives affect the way those involved define, identify and prioritize problems associated with the opioid epidemic, as well as how they identify success.

Through the Grand Challenge, IU aims to keep key stakeholders and policymakers up to date with substance use disorder news, research, policy, legislation, regulation and case law.

Identifying Recovery Trends During the Pandemic

Those with substance use disorder have been uniquely affected by social distancing and the closure of "nonessential" businesses — which have often included organizations supporting patients who are in recovery. Over 81,000 drug overdose deaths occurred in the United States in the 12 months ending in May 2020, the highest number of overdose deaths ever recorded in a 12-month period, according to recent provisional data from CDC. While overdose deaths were already increasing in the months preceding the 2020 COVID-19 pandemic, the latest numbers suggest an acceleration of overdose deaths during the pandemic.

During the early start of the pandemic, researchers from the Responding to the Addictions Crisis Grand Challenge gathered first-hand reports from 48 adults with a substance use disorder (40% of the sample with opioid use disorder), ages 26 to 60, to learn about the early effects of the COVID-19 pandemic on their recovery.

IU researchers have found that while there are significant challenges, many in recovery are showing great resilience in the face of the pandemic, overcoming challenging obstacles to maintain their recovery. Additionally, flexibility in treatment services and initiatives that keep people connected are key to supporting long-term recovery during the pandemic.

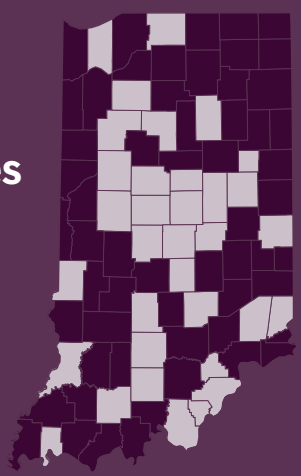
"It is on us all to intentionally care for each other during this pandemic and to be fully alert to ways in which we can actively support people in recovery who need access to health care, stable housing and community to ensure sustained sobriety."

—KEVIN LADD, IU SOUTH BEND PROFESSOR OF PSYCHOLOGY AND DIRECTOR OF THE SOCIAL PSYCHOLOGY OF RELIGION LAB

Confronting the addictions crisis with initiatives in

34

counties throughout Indiana.



IU RESEARCH: A TRADITION OF IMPACT

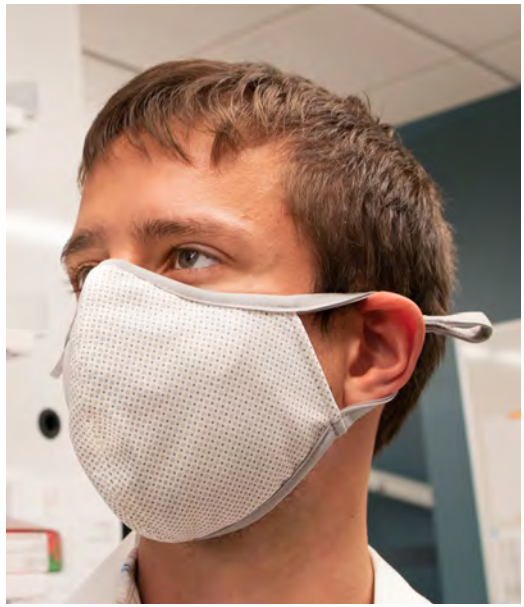
Amid the onset of the global pandemic, IU researchers pivoted swiftly, joining the shared fight against COVID-19 and implementing new protocols to safely continue other critical research.

From partnering with state officials to study and track the spread of COVID-19 across Indiana, to advising hospital systems and public health professionals and highlighting the disproportionate impact of the pandemic's economic and health effects on communities, IU's COVID response has been comprehensive — and remains ongoing.

Researchers also continued pursuing major priorities in high-performance computing, national security, racial justice and the arts and humanities — among many other disciplines across the institution. Read more about the full scope and impact of IU's research enterprise at research.impact.iu.edu.

IU Research Shows Electroceutical Fabric Eradicates Coronaviruses

A team of researchers at Indiana University published significant research findings demonstrating for the first time that coronaviruses are killed upon exposure to an electroceutical fabric. Their findings led to the development of new electroceutical face masks and personal protective equipment (PPE).



The electroceutical surface technology, called V.Dox Technology, is a proprietary dot-matrix pattern of embedded microcell batteries that create an electric field and wirelessly generate a low level of electricity when moist.

Coronaviruses rely on electrostatic interactions to be able to attach to their host and assemble themselves into an infective form. Their structure must remain stable in order to spread infection. The IU researchers sought to exploit the coronaviruses' own electrokinetic characteristics to try to dismantle their infectivity, and the research shows it works.

Tracking COVID-19 in Indiana

As the COVID-19 pandemic took hold in Indiana, IU researchers were critical to the creation of an interactive dashboard to allow state officials to track and visualize the spread of COVID-19 across the state. The dashboard included information about positive cases, hospital admissions, deaths and other data, and was color-coded and easy to understand. The dashboard labels county and statewide data as green (decreasing), yellow (inconclusive) or red (increasing). An asterisk is used to mark early warning areas, which are locations where the numbers in the last three days are higher than in the previous seven days, which could signal an increasing trend.

On the dashboard, users can also see data from earlier and more recent dates that are outside the "trending" areas, as well as information about comorbidities, average length of hospital stay and genetic breakdowns of those who have tested positive for the novel coronavirus. All of these data points can help researchers and state leaders make decisions about the best path forward.

> **"Part of the goal is to be able to identify what is happening quickly so that we can respond to any outbreak."**
>
> —SHAUN GRANNIS, MD, REGENSTRIEF CHAIR IN MEDICAL INFORMATICS, INDIANA UNIVERSITY SCHOOL OF MEDICINE

Indiana State Department of Health, IU Partner on COVID-19 Study

The Indiana State Department of Health is engaged in ongoing collaboration with the Indiana University Richard M. Fairbanks School of Public Health at IUPUI to conduct a scientific study to measure the spread of COVID-19 throughout the state.

In total, the study, which was announced in April 2020, will include tests of at least 20,000 Hoosiers over four separate phases.

282

patent applications filed.

> **"Data is key in guiding our response in the fight against COVID-19, and our partnership with Fairbanks School of Public Health researchers will provide high-quality information to help shape our decision-making."**
>
> —GOV. ERIC J. HOLCOMB

Indiana University Health and Eli Lilly and Co. are processing the nasal samples and reporting results to ISDH. The final phase of testing will take place in April 2021.

Identifying and Addressing Housing Disparities in Black Neighborhoods

Renters in Marion County neighborhoods with larger concentrations of Black and nonwhite residents spend a greater percentage of their income on rent, making it difficult to save enough money to make a down payment on a home purchase, an IU study found.

Research on housing disparities consistently shows that white residents are more likely to be homeowners than Black residents, placing Black families at a disadvantage. To begin to remedy those disadvantages, a research team from the Center for Research on Inclusion and Social Policy at the IU Public Policy Institute recommends that lenders, leaders and other stakeholders look at the ways their organizations can play a role in making affordable housing more attainable for Black residents and how they can help address the systemic lack of resources in predominately Black neighborhoods. These two changes can help more Black families begin to build their wealth through homeownership.

Empowering National Defense with Advanced Information Systems

Collaborative research in artificial intelligence and quantum science is being enabled by new Cooperative Research and Development Agreements between the Naval Surface Warfare Center, Crane Division (NSWC Crane) and IU. The quantum research program will develop technology to detect and measure the effects of radiation on quantum information systems, with the goal of developing a radiation-hardened quantum information processor for the field. The artificial intelligence work is focusing on developing fully autonomous and rational behaving machines that collect and deliver critical data while they explore unknown terrain.

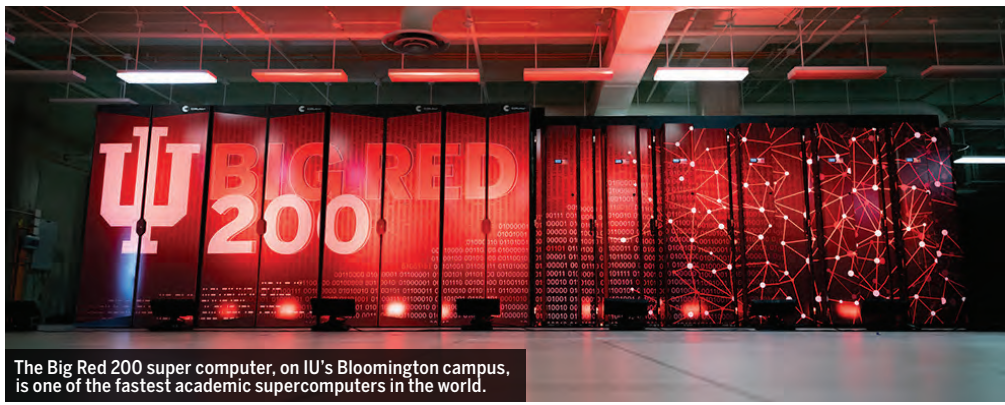
IU is also a part of a new university-based partnership called the National Security Academic Accelerator program, a part of the National Security Innovation Network. The IU accelerator will leverage the university's strengths in applied artificial intelligence and machine learning as

well as quantum information science to speed technology development and the transition of new technologies for use in both government and commercial markets.

World-class Supercomputing Power Supporting New Discoveries, National Defense

With the inauguration of Big Red 200 in early 2020, IU became home to one of the fastest academic supercomputers in the world. Its speed and superpower can be deployed to understand climate systems, advance artificial intelligence and machine learning investigations and accelerate discoveries related to genetics and to diseases such as Alzheimer's.

Big Red 200 is also connected to the National Security Innovation Network (NSIN), a first-of-its-kind warfare center that connects universities throughout Indiana to the Naval Surface Warfare Center, Crane Division, via a secure high-speed fiber network known as the I-Light network. NSIN gives collaborating researchers the ability to exchange and store huge data files, enabling contributions of innovative research, knowledge and problem-solving expertise to advance national security and defense.



The Big Red 200 super computer, on IU's Bloomington campus, is one of the fastest academic supercomputers in the world.

2,975 external funding awards.

secured in 2020, a *new university record*

PARTNERS

From local governments and state agencies to Indiana businesses and peer institutions, partnerships with stakeholders across Indiana and the nation are at the core of ensuring a lasting and meaningful impact for Indiana University research.

Precision Health Initiative Partners

Eli Lilly and Company
Eskenazi Health
Indiana Clinical and Translational Sciences Institute
IU Health
Purdue University:
Department of Biomedical Engineering
Department of Computer Science
Department of Electrical Engineering
Department of Computer Engineering
Regenstrief Center for Health Engineering
St. Vincent/Ascension Health
Vera Bradley Foundation for Breast Cancer

Prepared for Environmental Change Partners

Allen County Department of Environmental Management
Accelerate Indiana Municipalities
Association of Indiana Counties
Center for Inquiry
Citizens Energy Group
City of Bloomington
City of Carmel
City of Columbus
City of East Chicago
City of Elkhart
City of Evansville
City of Fishers
City of Fort Wayne
City of Gary
City of Goshen
City of Greencastle
City of Hobart
City of Huntington
City of Indianapolis
City of Lake Station
City of La Porte
City of Michigan City
City of Muncie
City of New Albany
City of New Castle
City of Oldenburg
City of Richmond
City of South Bend
City of Terre Haute
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Christopher B. Burke Engineering
Crawford County
Cyberinfrastructure Integration Research Center
Delaware County
Duke Energy Foundation
Earth Charter Indiana
Electrification Coalition
Great Plains Institute
Groundwork Indy
Health by Design
Hoosier Environmental Council
ICLEI—Local Governments for Sustainability
Indiana Agriculture and Nutrient Alliance
Indiana Clean Lakes Program
Indiana Department of Environmental Management.
Indiana Department of Homeland Security
Indiana Department of Natural Resources
Indiana Geological and Water Survey
Indiana Office of Community and Rural Affairs
Indiana Public Health Association
Indiana Public Media
Indiana State Museum
Indiana State University
Keep Indianapolis Beautiful
Kheprw Institute
Lake County
La Porte County
McKinney Family Foundation
Monroe County
Monroe County History Center
Monroe County Identify and Reduce Invasive Species
Monroe County Parks and Recreation
Minnesota Aquatic Invasive Species Research Center
Minnesota Department of Natural Resources
Noble County
Noble County Plan Commission
Northwest Indiana Regional Planning Commission
Porter County
Purdue Climate Change Research Center
Solar Foundation
St. Joseph River Basin Commission
Town of Cedar Lake
Town of Chesterton
Town of Clarksville
Town of Culver
Town of Dyer
Town of Highland
Town of Merrillville
Town of Munster
Town of Schererville
Town of Spencer
Town of Zionsville
Tippecanoe County
University of North Florida
University of Minnesota
University of Wisconsin-Stevens Point
US Environmental Protection Agency

US Geological Survey

Wisconsin Department of Natural Resources

WonderLab Museum of Science,Health & Technology

Responding to the Addictions Crisis Partners

Addictions Coalition of Delaware County

Bauer Family Resources

Ben Davis 9th Grade Center

Ben Davis High School

Bowen Center

Brothers United (BU) Wellness Center

Butler University College of Pharmacy and Health Sciences

Carmel High School

Cass County

Catholic Charities Bloomington

Centers for Disease Control and Prevention

Centerstone

City of Lawrenceburg

Clark County

Clay County

Clinton County

Community Hospital East

Community Solutions Inc.

Cummins Behavioral Health

Drug Free Marion County

Dubois County

Eskenazi Community Health Centers

Eskenazi Health Center Cottage Corner

Eskenazi Health Substance Abuse Expansion Program

Eskenazi Transgender Health Clinic

Evansville City Council

Fairbanks Treatment and Recovery Center

Family and Social Services Administration

Floyd County

Four County Counseling Center

Franciscan Health Center

Grace Recovery

Harrison County Hospital

HC1

Healthy Families

Hickory House Residential Treatment Center

Home with Hope

HOPE Center

Indiana Area Health Education Centers Network

Indiana Addictions Issues Coalition

Indiana Association of Peer Recovery Support Services Tippecanoe Chapter

Indiana Cancer Consortium

Indiana Data Partnership

Indiana Department of Child Services

Indiana Department of Corrections

Indiana Department of Homeland Security

Indiana Health Information Exchange, IU Health

Indiana Hospital Association

Indiana Judicial Opioid Initiative

Indiana Management Performance Hub

Indiana Network for Patient Care

Indiana Primary Health Care Association

Indiana Recovery Alliance

Indiana Rural Health Association

Indiana Rural Opioid Consortium

Indiana State Department of Health

Indiana State Museum

Indiana Women's Prison

Indianapolis EMS

Indianapolis Fire Department

Indianapolis Metropolitan Police Department

Indianapolis Public Safety Coalition

ISDH Eliminate Hepatitis Advisory Council

IU Health Arnett Hospital

IU Health Ball Memorial Hospital

IU Health Bedford Hospital

IU Health Behavioral Health Collaborative

IU Health Blackford Hospital

IU Health Bloomington Hospital

IU Health Frankfort Hospital

IU Health LifeCare Clinic

IU Health Methodist Hospital

IU Health North Hospital

IU Health Paoli Hospital

IU Health Saxony Hospital

IU Health Tipton Hospital

IU Health West Hospital

IU Health White Memorial Hospital

Ivy Tech Community College

LifeSpring Health Systems Recovery Center Management Performance Hub

Marion County Public Health Department Syringe Services

Marion County Public Health Department Maternal and Child Health Division

Marion County Public Health Department Substance Use Outreach Services Program

Memorial Hospital and Health Care Center

Meridian Health Services

Midtown Dual Diagnosis Clinic

Midwest Aids Training and Education Center

Monroe County Health Department

Montgomery County EMS

North Central High School

Opioid Learning Collaborative Eskenazi

Overdose Lifeline

Pam's Promise

Pendleton Correctional Facility

Porter County

Porter Starke Services

Project Point at Eskenazi and Methodist Hospitals

Purdue College of Pharmacy

Raphael and HealthNet Community Health Centers

Same Page Transitional Housing

Salvation Army

Scott County

St. Vincent Evansville

Tippecanoe County Health Department Syringe Service Program "Gateway to Hope"

Tippecanoe County Opioid Task Force

Tippecanoe County Probation Department

Tippecanoe County Recovery Subcommittee

Tippecanoe County Women, Infants & Children (WIC) Office

Transforming Adolescents and Families in Indiana Alternative Peer Group

Trinity Recovery House

University Hospital Centering Group

University of Southern Indiana

Valle Vista Health System residential treatment facility

Valley Oaks Health

Volunteers of America Fresh Start Recovery Center

Wayne County

Wayne County Probation Department

White County

University of Pittsburgh School of Public Health

INDIANA UNIVERSITY
GRAND CHALLENGES