



Stanford Center for Precision Mental Health and Wellness

Annual Report

DECEMBER 2021



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STANFORD CENTER FOR PRECISION MENTAL HEALTH & WELLNESS

401 QUARRY RD, PALO ALTO, CA, USA 94304

A new approach to mental health is on the horizon. And it will be more transformative than any of us can possibly imagine. It is empowered by an understanding of our own brain. The greatest innovations and opportunities to scale are ahead of us. We want to be part of this transformation in our lifetime. This is why we founded the Center for Precision Mental Health and Wellness. We need great scientists, entrepreneurs, and trailblazers to build this new world for mental health.

Mental disorders touch us all. Their impact is felt across the lifespan, but mental disorders are the most common health problem for young people. All too often they are terminal. Currently, mental disorders are diagnosed by clinical observations. There are no tests to aid diagnosis, subtyping, or treatment selection. Individuals often cycle through a series of therapies, hoping that one of them will work. Getting the 'right treatment' at the first intervention is paramount.

Our Center combines high tech, data, and neuroscience to detect different types of mental disorders more precisely and associate them with specific treatment outcomes. This approach is doing for mental health what has occurred in other medical domains such as cancer treatment: advancing clinical practice by personalizing and matching treatments more effectively to each version of the underlying disease. Clinicians can then strategically select the most effective treatment for each person, get it to them sooner, and keep them well longer.

The "Framingham study" was a moonshot that transformed how we understand and care for our heart. No longer do half of American adults die from heart disease. The Framingham study taught us that to accelerate findings into practice, we need to embed our research within local communities, study real world cohorts, and partner with visionaries. It gave us an understanding of the biology of our heart, and we use it to develop sensors that track our heart health and alert us to when we need a more detailed assessment. Now is the time to make the same transformation for mental health.

To accelerate change, our Center is unified around three research thematic areas:

Precision Preventions and Diagnostics. Develop precise tests for detecting mental illness and risk factors. Integrate circuit, behavioral, and physiological measures, across the lifespan. Improve quality of life and reduce suicidality.

Precision Treatment Matching. Optimize neuroscience-based measures to get the right treatment to each person sooner. Limit trial-and-error. Include medication, neuromodulation, behavioral and digital treatments, across the lifespan. Keep people well longer and reduce suicidality.

Precision Strategies for Novel and Exploratory Therapeutics. Advance new treatments, including selective 'repurposed' compounds, entactogens, ketamine, psychedelics, and digital therapies. Use neuroscience-based measures to understand benefits and risks, who they are effective for and why.

Our Center is the symbiosis for accelerating progress in each area and for igniting new discovery. Stanford's preeminence in precision mental health depends on active collaborations between disciplines and dynamic engagements with scientific, clinical, and industry trailblazers. Our Center has a vital partnership between Stanford and the Precision Medicine Core of the Mental Illness Research, Education and Clinical Center of Excellence (MIRECC) at the Palo Alto VA. We purposefully translate insights from human clinical studies back to basic science models. Our research members are experts in each of the discipline areas necessary for transforming mental health, including clinical neuroscience, basic neuroscience, psychiatry, psychology, engineering, brain imaging, biomarkers, innovative trial design, medicines, therapies, psychedelics, biomedical data sciences, computation, sensors, and public health, creating a transformative approach to mental health.

Leanne Williams, Ph.D.

Director, Stanford Center for Precision Mental Health and Wellness



Stanford
MEDICINE

Department of Psychiatry and
Behavioral Sciences



A Message from Our Department of Psychiatry and Behavioral Sciences Chair

Precision mental health is integral to precision health.

With our experiences during the pandemic and with ongoing challenges across the world, we are more aware today than ever before of just how precious our mental wellbeing is.

As a leader in academic medicine, I feel so fortunate to have a sense of the extraordinary progress across the biomedical sciences and within psychiatry specifically. It's wonderful to see and support the translation of scientific discovery to clinical care, allowing prevention and treatments that restore good lives for people and families, and at scale create better lives for all within communities and populations. Together with our patients, scientists, clinicians, trainees and staff, we at Stanford are creating a new paradigm for modern psychiatry. The Center for Precision Mental Health and Wellness is a key to this new paradigm. Stanford's Department of Psychiatry and Behavioral Sciences is the nation's epicenter for precision psychiatry.

The Center's advances are made possible through a truly collaborative approach, bringing more precise diagnoses and treatments based on neuroscience discoveries to help people, families, communities, populations and to help future generations. Major mental health disorders are very common, affecting hundreds of millions of people worldwide, they hit early, they hit hard, and unrecognized and untreated they can change the trajectory of a lifetime and of generations. Though treatment is remarkably effective in improving quality of life and reducing the burden of symptoms and impairments, finding the right treatment is too often a process of months or years. Moreover, mental disorders may complicate and worsen the risks associated with other health conditions. For example, depression increases the risk of cardiovascular-related deaths threefold.

Mitigating such mental health consequences requires the best cutting-edge prediction, prevention and preemption strategies that translational neuroscience can provide. Harnessing advances in the fields of biomedical sciences, medicine, engineering, education, social sciences, and ethics will be key in revolutionizing the diagnosis and treatment of mental illness with greater precision, personalized care and precision health.

In this past year, it has been my great pleasure to announce the launch, here at Stanford, of a First-in-world Translational Precision Mental Health Clinic. This exciting new clinic will make scientific breakthroughs in precision psychiatry available to our patients. Because of its pioneering new approaches, the Center is leading the way for precision psychiatry within our field. Other centers at other institutions are already seeking to model their approach on the approach we have here at the Stanford Department of Psychiatry and Behavioral Sciences. In these many ways, the Center for Precision Mental Health and Wellness is a shining example of how our department has become a platform from which to branch out and serve our campus, our community, and our world.

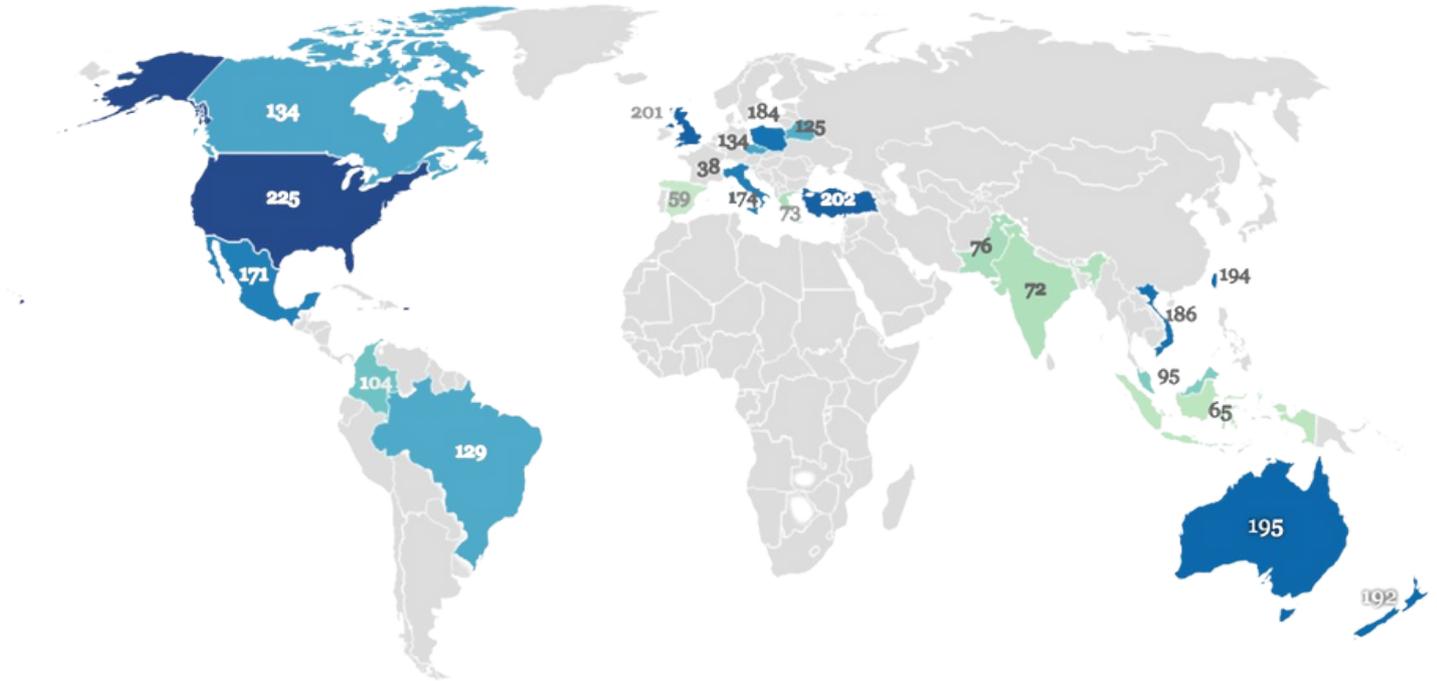
We welcome your engagement and ongoing partnership as we realize the biomedical revolution for modern precision psychiatry.

Laura Roberts, M.D.
Chairman, Department of Psychiatry and Behavioral Sciences
Katharine Dexter McCormick and Stanley McCormick Memorial Professor
Editor-in-Chief, Books, American Psychiatric Association
Editor-in-Chief, Academic Medicine

Symposium Audience

350 Total Viewers
624 Total Registrants

Longest Minutes Watched (per individual)



BY THE NUMBERS

2021
9,520 UNIQUE PROFILE VISITS
278 NEW FOLLOWERS
81 TOTAL MENTIONS
36,679 TWEET IMPRESSIONS



2021
13,045 UNIQUE VISITORS
FROM
51 COUNTRIES



2021
341 NEW FOLLOWERS
7,392 TOTAL IMPRESSIONS

2021
461 NEW FOLLOWERS
62.9K ACCOUNTS REACHED





6600+ BRAIN SCANS COMPLETED

FOR CLINICAL & HEALTHY POPULATIONS

CITATIONS

1,339,862

OF WORK PUBLISHED BY ALL CENTER
RESEARCH MEMBER

RESEARCH

IMPACT

5200+
STANDARDIZED
COGNITIVE TESTS

7000+

QUESTIONNAIRES
COMPLETED PERTAINING
TO VARIOUS ASPECTS OF
MENTAL HEALTH &
WELLBEING

63

Center
Research
Members

MEMBERSHIP
ACROSS
FIVE
SCHOOLS

2700+ | DATA COLLECTED ON
GENETIC SINGLE
NUCLEOTIDE
POLYMORPHISMS

Meet our

STANFORD PMHW FACULTY LEADERSHIP

TRAILBLAZING A NEW APPROACH TO MENTAL
HEALTH ACROSS THE GLOBE



Leanne Williams, PhD
Director



Ruth O'Hara, PhD
Co-Director



Alan Schatzberg, MD
Associate Director



Meet our

STANFORD PMHW PROGRAM LEADERSHIP & EXECUTIVE TEAM

SUPPORTING THE TRANSFORMATIVE
APPROACH TO MENTAL HEALTH



Laura Hack, MD, PhD
Director of Novel & Precision
Neurotherapeutics Program



Leonardo Tozzi, MD, PhD
Director of Computational
Neuroscience &
Neuroimaging Program



John Hegarty, PhD
Associate Director of
Strategic Program
Development



Hosna Omarzad, MS
Executive Director



Anna Boken
Executive Assistant

Join Us

STANFORD PMHW RESEARCH MEMBERS

IN CHANGING THE LANDSCAPE OF MENTAL
HEALTH ACROSS THE GLOBE



Russ Altman, MD, PhD



Eric Appel, PhD



Zhenan Bao, PhD



Michele Berk, PhD



Mahendra Bhati, MD



Jing Bian, PhD



Catherine Blish, MD, PhD



Hector Bonilla, MD



Daniel Bowling, PhD



Kim Bullock, MD, PhD



Weidong Cai, MD, PhD



David Camarillo, PhD



Vinicio de Jesus Perez, MD



Charles DeBattista, MD



Manisha Desai, PhD



Timothy Durazzo, PhD



Neir Eshel, MD, PhD



Lawrence Fung, MD, PhD



Grace Gengoux, PhD



William Giardino, PhD



Gary Glover, PhD





Andrea Goldstein-Piekarski, PhD



Tamar Green, MD



Kevin Grimes, MD



Boris Heifets, MD, PhD



Keith Humphreys, PhD



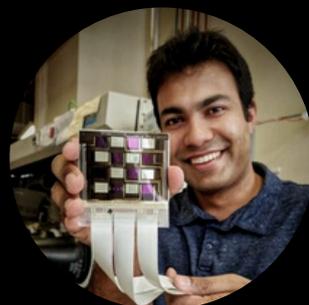
Agnieszka Kalinowski, MD



Makoto Kawai, MD



Corey Keller, MD, PhD



Yasser Khan, PhD



Brian Knutson, PhD



Tze L. Lai, PhD



John Leikauf, MD



Feng Vankee Lin, PhD



Sean Mackey, MD, PhD



Michelle Madore, PhD



Yvonne Maldonado, MD



Vinod Menon, PhD



Kari Nadeau, MD, PhD



Douglas Noordsy, MD



Michael Ostacher, MD



Claudia Padula, PhD



Pablo E. Paredes, PhD



Jeffrey Pfeffer, PhD



Russell Poldrack, PhD





Raul Poulsen, MD



Lisa Goldman Rosas, PhD



Brian Rutt, PhD



Debra Safer, MD



Manish Saggar, PhD



Gregory Sahlem, MD



Shebani Sethi, MD



Michael Snyder, PhD



Eric Stice, PhD



Kaustubh Supekar, PhD



Trisha Suppes, MD, PhD



Ranak Trivedi, PhD



**Peter Johannes van
Roessel, MD, PhD**



**Janani
Venugopalakrishnan, MD**



Gordon Wang, PhD



Nolan Williams MD



Hua Wu, PhD



Jerome Yesavage MD





Stanford
MEDICINE

Spectrum

Stanford Center for Clinical & Translational Research & Education



Stanford
MEDICINE

Mood Disorders Center

Department of Psychiatry and Behavioral Sciences



Innovative Medicines
Accelerator

A ChEM-H Partnership With Stanford Medicine



U.S. Department of Veterans Affairs

Veterans Health Administration

VA Sierra Pacific Network (VISN 21)



MIRECC

Mental Illness Research, Education &
Clinical Center of Excellence, Palo Alto VA

RESEARCH
CENTERS
AND
PARTNERS

PMHW Corporate Members Program

BE A MENTAL HEALTH THOUGHT LEADER

Through the development of this program, we aimed to engage with organizations and corporate leaders across the United States and the world. Members share in the Center outcomes with a mutual goal to improve mental health and wellness in addition to connecting and building relationships with Stanford faculty. The program supports the Center's mission to reimagine mental health based on cutting edge insights from data, technology and therapeutics.

FOUNDING MEMBER FOR
PRECISION PSYCHIATRY
& THERAPEUTICS



**Boehringer
Ingelheim**

Improving the health and quality of life of humans and animals is the goal of Boehringer Ingelheim. Family-owned since its foundation in 1885, the research-driven pharmaceutical company has a rich pipeline in all phases of development, including mental health. Boehringer Ingelheim and the Stanford Center for Precision Mental Health and Wellness share a mutual interest in identifying neuroscience-based behavior and imaging markers to guide the development of targeted therapies for major mental illnesses and subtypes for which no satisfactory treatment option exist to date. By advancing new and innovative approaches and technologies to inform treatment development, we share the goal of redefining mental health to enable people to thrive.

2021 PMHW EVENTS

November

12

**Stanford Precision Mental Health & Wellness Seminar Series:
Dr. Lorenzo Pasquini**

November

4

**PMHW & MIRECC Virtual Training
"Implementation Science and
Precision Medicine Approaches in
Mental Health"**

October

25

**Stanford Precision Mental Health & Wellness Seminar Series:
Dr. Isaac V. Kauvar**

September

24

**Stanford Precision Mental Health & Wellness Anniversary Symposium:
Dean Lloyd B. Minor, MD
Laura Roberts, MD, MA**

January

28

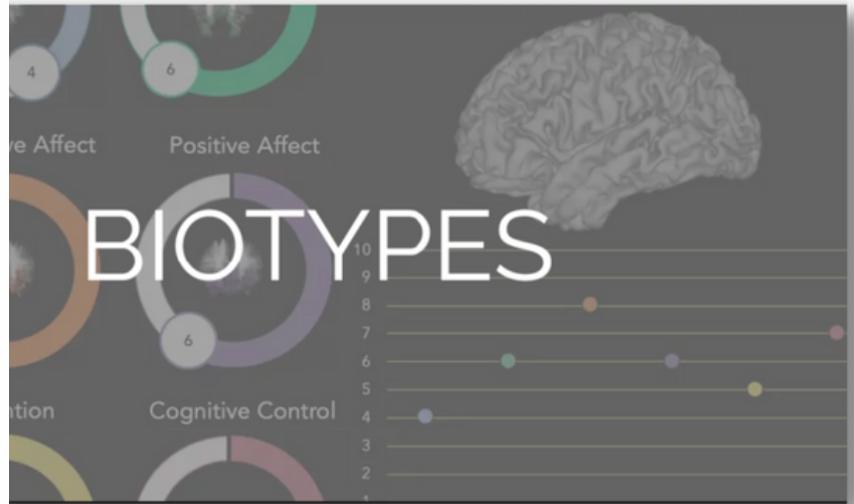
**Stanford Precision Mental Health & Wellness Seminar Series:
Dr. Gary H. Glover**

RESOURCES

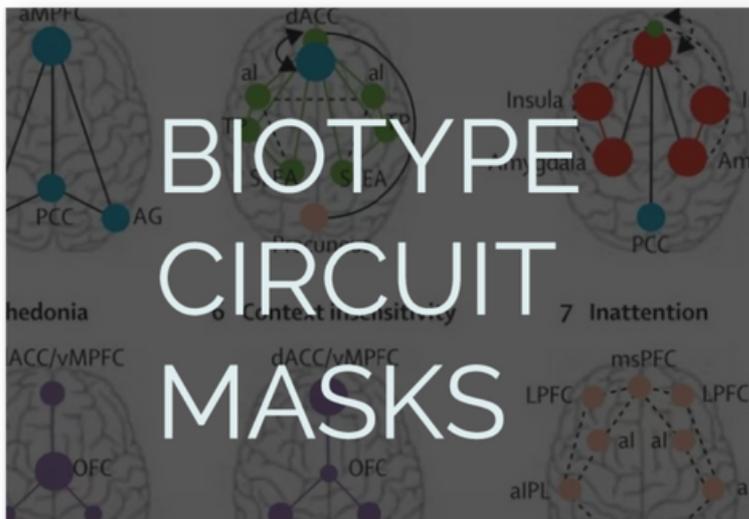


We have formulated the first biotype taxonomy for depression and anxiety using high-definition MRI technology.

BIOTYPES



BIOTYPE CIRCUIT MASKS



This resource includes the regions of interest (ROIs) used for the quantification of circuits of interest in an article published in *Biological Psychiatry*, 2021.

PMHW has built an extensive dataset for mental health research. Our database comprises of data collected across clinical and healthy populations using several different modalities.

DATASETS



Using biotypes to get the right treatment to the right person at the right time

Why is Social Connection Important?

The science of social connection and its benefit on our mental and physical well-being.

What is Social Connection?

Social connection is a subjective experience where one feels a sense of belonging with others.



Physical Health

Social connection has been shown to improve our physical health. For example, being more connected to others strengthens our immune system and helps us fight disease faster!



Happiness

Social connection provides individuals with a sense of belonging and can increase our feelings of happiness.



Decrease in Stress

When individuals feel a sense of belonging and connectedness, their stress levels decrease and result in a calmer state of mind.



It's Human Nature

Human brains have been wired to socialize. Like food, water, and sleep, all necessities to survive, we desire connection. Social interaction allows us to feel a sense of purpose, gain knowledge, and increase self-esteem.



Now More Than Ever

As a result of the COVID-19 pandemic, we all have been deprived of social connection with our friends for almost a year. During that time, we experienced an increase in stress, loneliness, and anxiety. It's important to regain our feelings of belonging in order to live happier and healthier lives.

Eat your greens, drink water, and connect

Just like how unhealthy eating habits can lead to health issues down the road, a lack of social connection can increase vulnerability to disease and other risk factors. So, always make sure to get your daily dose of connection!

Graphic By Sean Nesamoney
PMHFW Creative Science Communications Group
For more information, visit: <http://fremd.stanford.edu/pmhw>

BIOTYPES

WHAT ARE BIOTYPES?

A biotype is one of six possible neural pathways in your brain. Researchers in mental health science have discovered that people get these circuits on through mental equilibrium. They are called biotypes. Biotypes affect how you interact, behave and cognitive control.

HOW CAN UNDERSTANDING THEM HELP?

Learning how to understand through people's biotypes, they can help us better understand our brains, which can show us ways to understand and better tackle our health issues. In stressful times like these, a better understanding of our brain can make a huge difference.

MANAGE COVID STRESS

As you like stress, when stress is not allowed to understand the learning curve of a person's mind, it can lead to a state of panic. Each biotype has a different way of coping and managing stress.

UNDERSTAND YOUR BRAIN

Learning to understand your brain can help you better understand your brain. It can help you understand your brain's different parts, how they work, and how they interact with each other. This can help you understand your brain's different parts, how they work, and how they interact with each other.

HUMAN CONNECTION

Understanding how to connect with others can help you better understand your brain. It can help you understand your brain's different parts, how they work, and how they interact with each other.

BATTLE ILLNESSES

Understanding how to battle illnesses can help you better understand your brain. It can help you understand your brain's different parts, how they work, and how they interact with each other.



WHAT THEY ARE:

- Your brain is composed of 100 billion neurons.
- Neurons are organized into circuits.
- Neural circuits, the electrical lines, can malfunction.
- These different circuit malfunctions cause different biotypes.



WHY WE NEED TO KNOW THIS:

- In situations where we are under constant negative stress, our brain circuits may malfunction. This is a warning sign of mental health issues.
- Depression is not contagious, just as there are different types of stress. There are also different types of depression.
- Understanding your biotype will help you better understand your brain's different parts, how they work, and how they interact with each other.
- Recognizing your biotype doesn't necessarily mean you have mental depression, but it can help you understand your brain.

COMMON SYMPTOMS

ADDITION	EMOTIONAL RESPONSES
ANXIOUS AVOIDANCE	DISINTEGRATION
NEGATIVE FEELINGS	INTENTION
FRIGHT RESPONSE	COGNITIVE JOBS

TIPS AND TRICKS

ADDITION	EMOTIONAL RESPONSES
ANXIOUS AVOIDANCE	DISINTEGRATION
NEGATIVE FEELINGS	INTENTION
FRIGHT RESPONSE	COGNITIVE JOBS

Creative Science Communications Group

BE THE FUTURE OF MENTAL HEALTH AWARENESS

The Creative Science Communications Group is a yearly educational program involving students with a passion and interest in mental health research. Students engage with Stanford researchers through the Center, learning about the connection between the human brain and mental health. Students learn about how research and our findings translate into practice. In addition to receiving mentorship from research staff, students engage in a writing camp in which they develop skills in creative science writing.

Stanford University

Collaborative Funding

Accelerating progress in research
and igniting new discovery

The logo for INMA (Infection Recovery in SARS-CoV-2 Neurostudy) features the letters 'INMA' in a stylized, multi-colored font where each letter is composed of many thin, horizontal lines in various colors like red, blue, green, and yellow.

Stanford Innovative Medicines
Accelerator
Infection Recovery in SARS-CoV-2
(IRIS) Neurostudy - Phase 1

Stanford Innovative Medicines
Accelerator
Infection Recovery in SARS-CoV-2
(IRIS) Neurostudy - Phase 2



Stanford Institute for
Using Wearable Electrodermal
Activity (EDA) Sensors to Augment
ADHD Diagnosis

Stanford | ENGINEERING

Stanford Catalyst for
Collaborative Solutions

 **Stanford** | MEDICINE

Stanford School of Medicine
Clinical Translational
Biomedical Innovation Award

Collaboration

A black mouse cursor arrow pointing towards the bottom right corner of the orange 'Collaboration' button.



Federal Funding

NIH U01

Mapping connectomes for
disordered emotional states

NIMH R01

NMDAR Modulation As A
Therapeutic Target and Probe of
Neural Dysfunction in OCD

NIMH R01

Sleep disturbance and emotion regulation
brain dysfunction as mechanisms of
neuropsychiatric symptoms in Alzheimer's
dementia

NIH R01

Mechanistic circuit markers of
transcranial magnetic stimulation
outcomes in pharmacoresistant
depression

NIMH R61

A Novel Use of a Sleep Intervention to
Target the Emotion Regulation Brain
Network and Treat Depression and
Anxiety

NIDA P50

Project 4. Mapping the Influence of
drugs of Abuse on Risk and Reward
Circuits

NIH UH2/UH3

Engaging self-regulation targets to
understand the mechanisms of behavior
change and improve mood and weight
outcomes

Precision Mental
Health Research



*Thank you for
your support!*

We would like to express our sincerest gratitude to the great scientists, entrepreneurs, and trailblazers who support our mission to build this new world for mental health. Your contributions are making an impact on the acceleration of progress in the research and is igniting new discovery.

Thank you again for your continued interest in the Stanford Center for Precision Mental Health and Wellness. We value your support and encourage you to contact us with any questions.

**Stanford Center for Precision
Mental Health and Wellness**

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