



MindMed

# Opioid Use Disorder: Zolunicant's Potential For Unmet Treatment Needs

Thursday May 19, 2022 11:00 AM ET

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The United States federal government regulates drugs through the Controlled Substances Act. The Company works with a non-hallucinogenic synthetic derivative of the psychedelic substance ibogaine, known as "18-MC", which is a synthetic organic molecule designed around a common coronaridine chemical backbone. 18-MC is not a Schedule I substance in the United States and the Company does not foresee it becoming a Schedule I substance due to its non-hallucinogenic properties. While the Company is focused on programs using psychedelic inspired compounds and classic psychedelics, the Company does not have any direct or indirect involvement with the illegal selling, production or distribution of any substances in the jurisdictions in which it operates. The Company is a neuro-pharmaceutical drug development company and does not deal with psychedelic substances except within laboratory and clinical trial settings conducted within approved regulatory frameworks. The Company's products will not be commercialized prior to applicable regulatory approval, which will only be granted if clinical evidence of safety and efficacy for the intended uses is successfully developed.]

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# Agenda

Robert Barrow, CEO, Director of MindMed

Stuart Gitlow, MD, MPH, MBA

Kelly E. Dunn, PhD, MBA

MindMed Leadership

Moderated by Mr. Barrow

MindMed Introduction

Overview of substance use disorders

Current treatment landscape for opioid use disorder and the unmet medical need in the management of opioid withdrawal

MM-110 (zolunicant) clinical development program and its therapeutic potential in substance use disorders

Q&A



# Business Highlights

*Our mission is to deliver on the therapeutic potential of psychedelics and other novel targets to treat brain health disorders*

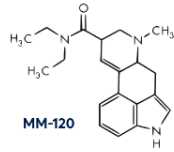
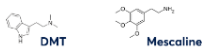

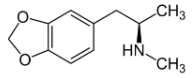
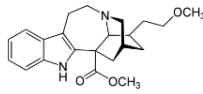
- **Leader in developing psychedelic** product candidates to treat brain health disorders
- **Diversified pipeline** of clinical programs targeting significant unmet medical needs
- **IP and R&D strategies** to maximize market exclusivity and protection
- **Leveraging decades of research** on clinical and preclinical potential of product candidates
- **Industry-leading expertise** in drug and digital medicine development and commercialization
- **Fully funded** through key clinical readouts and into 2024





# Advancing Multiple Generations of Drug Candidates

Our strategy is to deliver on well-characterized psychedelic candidates and next generation candidates with enhanced drug profiles

	CONCEPT	MINDMED PRODUCT CANDIDATES	PIPELINE EXPANSION OPPORTUNITIES
<b>CLASSIC PSYCHEDELICS</b>	<ul style="list-style-type: none"> <li>Clinical evidence of efficacy<sup>1</sup></li> <li>Well-characterized pharmacology</li> <li>Accelerated development potential</li> </ul>	 <p><b>MM-120</b></p>	<ul style="list-style-type: none"> <li>Expanded clinical indications</li> <li>Psychedelics with distinct PK/PD</li> </ul>  <p>DMT Mescaline</p>  <p>Universitätsspital Basel</p>
<b>2ND GENERATION / OPTIMIZED</b>	<ul style="list-style-type: none"> <li>Enhanced pharmacology</li> <li>Overcome safety liabilities</li> <li>Increased IP potential</li> </ul>	 <p><b>MM-402</b></p>	<ul style="list-style-type: none"> <li>Advanced drug delivery</li> <li>Novel treatment models</li> <li>Novel treatment regimen</li> </ul>
<b>3RD GENERATION / NCES</b>	<ul style="list-style-type: none"> <li>Analogues of classic psychedelics</li> <li>Require full development program</li> <li>Strongest IP potential</li> </ul>	 <p><b>MM-110</b></p>	<ul style="list-style-type: none"> <li>Novel tryptamines</li> <li>Novel phenethylamines</li> <li>Non-hallucinogenic analogues</li> </ul>

1. Gasser 2014; J. Nerv. Ment. Dis.; 202(7).

IP: intellectual property; DMT: N,N-dimethyltryptamine; NCE: new chemical entity; PD: pharmacodynamics; PK: pharmacokinetics

# Research & Development Pipeline

Our pipeline diversification offers potential opportunities across therapeutic areas and mechanisms of action

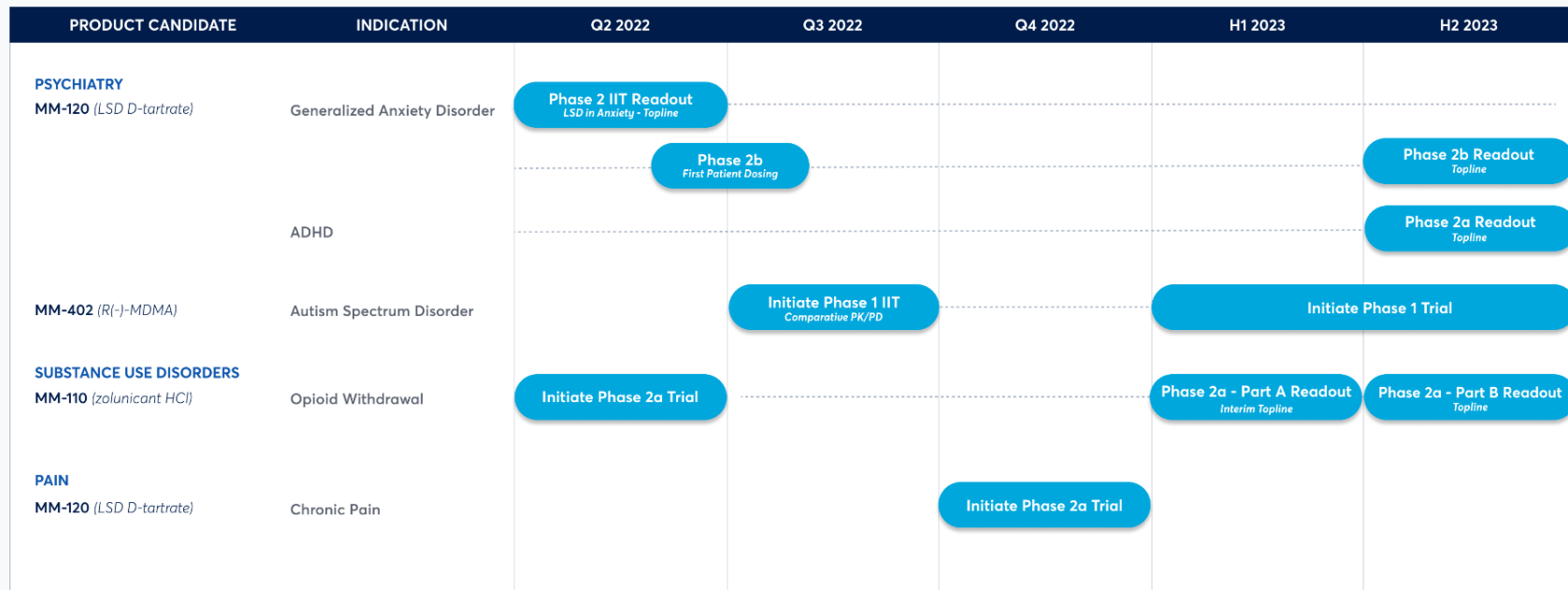
PRODUCT CANDIDATE	INDICATION	PRE-CLINICAL	PHASE 1	PHASE 2	PHASE 3	REGISTRATION
<b>PSYCHIATRY</b>						
<b>MM-120</b> (LSD D-tartrate)	Generalized Anxiety Disorder					
	ADHD					
<b>MM-402</b> (R(-)-MDMA)	Autism Spectrum Disorder					
<b>SUBSTANCE USE DISORDERS</b>						
<b>MM-110</b> (zolunicant HCl)	Opioid Withdrawal					
<b>PAIN</b>						
<b>MM-120</b> (LSD D-tartrate)	Chronic Pain					
<b>DISCOVERY &amp; EARLY DEVELOPMENT</b>						
<b>MM-823</b> (noribogaine BTLs)	Substance Use Disorders					
<b>Novel tryptamines</b>	undisclosed					
<b>Novel phenethylamines</b>	undisclosed					
<b>Advanced drug delivery</b>	undisclosed					

ADHD: Attention-Deficit/Hyperactivity Disorder



# Upcoming Portfolio Milestones

MindMed's clinical research portfolio creates multiple near-term and intermediate catalysts



ADHD: Attention-Deficit/Hyperactivity Disorder; IIT: investigator-initiated trial; R&D: research & development; ESOE: early sign of efficacy



# Stuart Gitlow, MD, MPH, MBA



**Dr. Gitlow, Past President of the American Society of Addiction Medicine and Past Chair of the AMA's Council of Science and Public Health**

Kelly E. Dunn, PhD, MBA



**Dr. Dunn, Associate Professor in the Behavioral Pharmacology Research Unit within the Department of Psychiatry and Behavioral Sciences in the Johns Hopkins University School of Medicine**



## **Supervised Opioid Withdrawal Unmet Need and 18-MC**

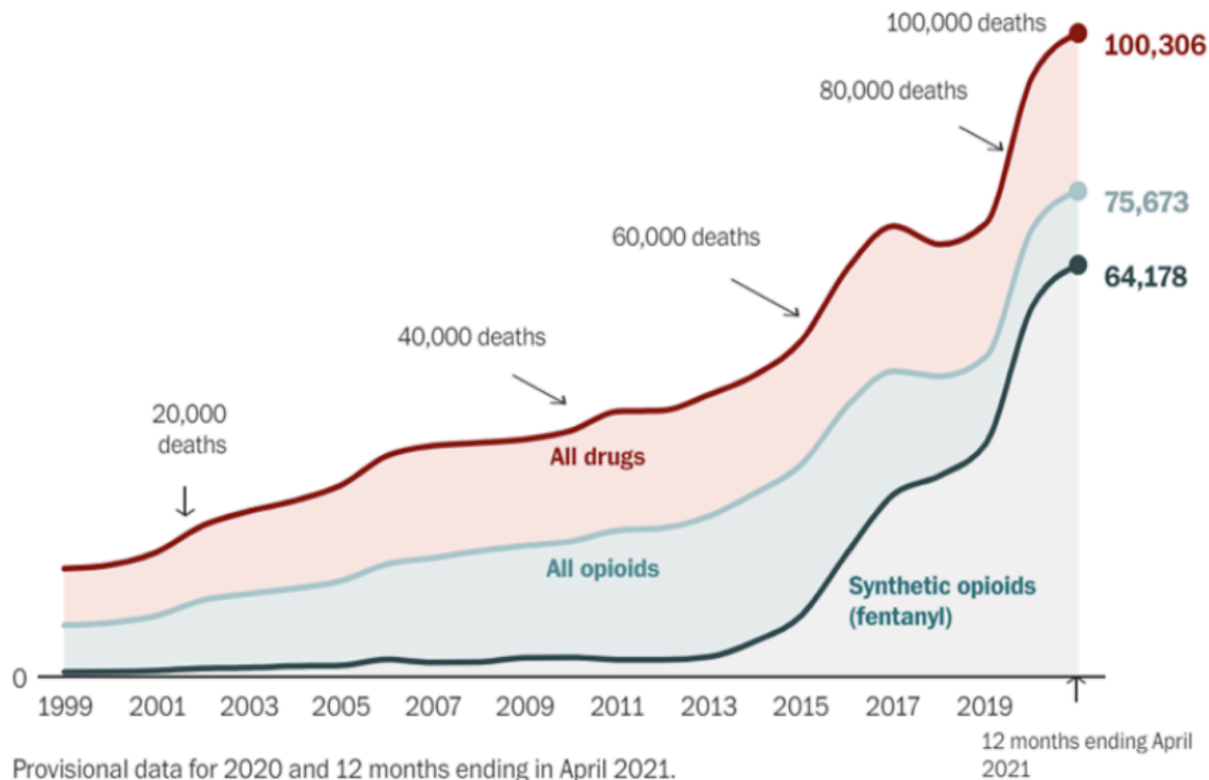
**Kelly E Dunn, Ph.D., MBA; JHUSOM**

### **Disclosures (past 3 years)**

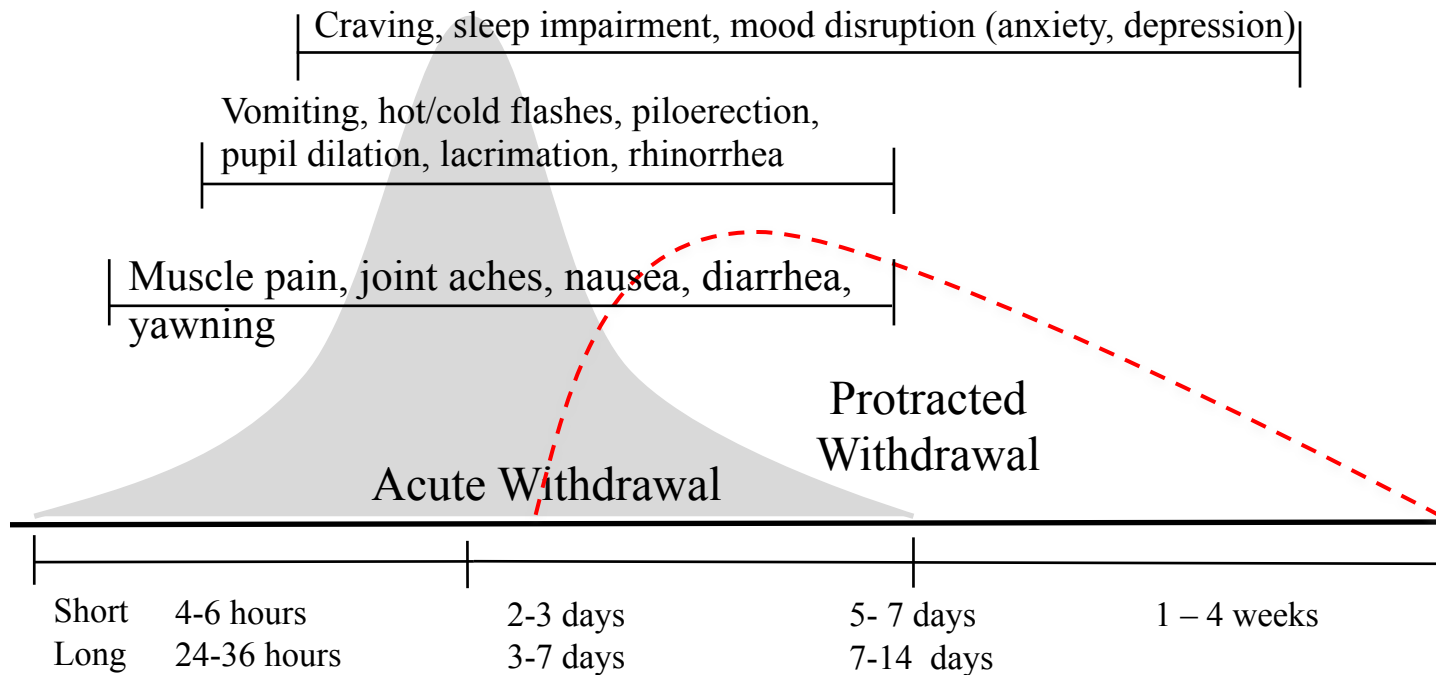
- Mind Med, Inc.; Canopy Corporation; Beckley-Canopy Corporation



# Waves 1 – 4 of the Opioid Crisis



# Opioid Withdrawal Syndrome



# Current OUD Treatment Options

## Treatment Type

## Medications for OUD

Agonist  
Maintenance



- Methadone
- Buprenorphine

Supervised Withdrawal  
(e.g., Detoxification)



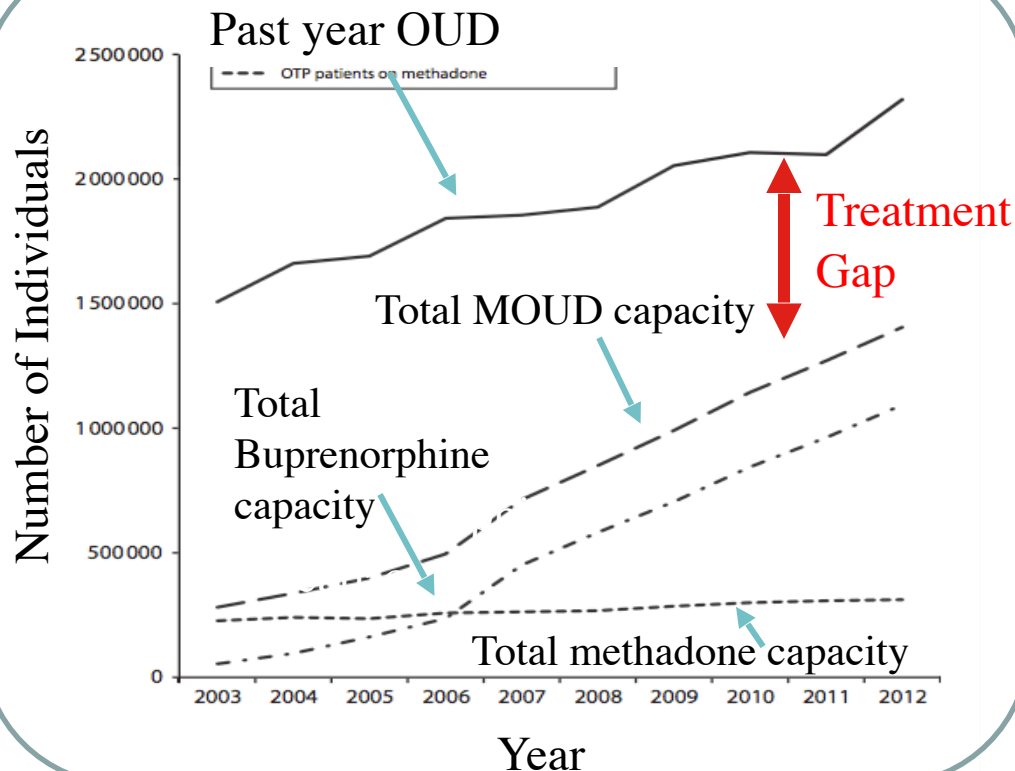
- Methadone
- Buprenorphine
- Lofexidine
- PRN medications

Relapse Prevention



- Naltrexone

# Significant Agonist Treatment Gap



96% of states had rates of OUD that exceeded capacity

In 78% of states, the majority of maintenance clinics were at  $\geq 80\%$

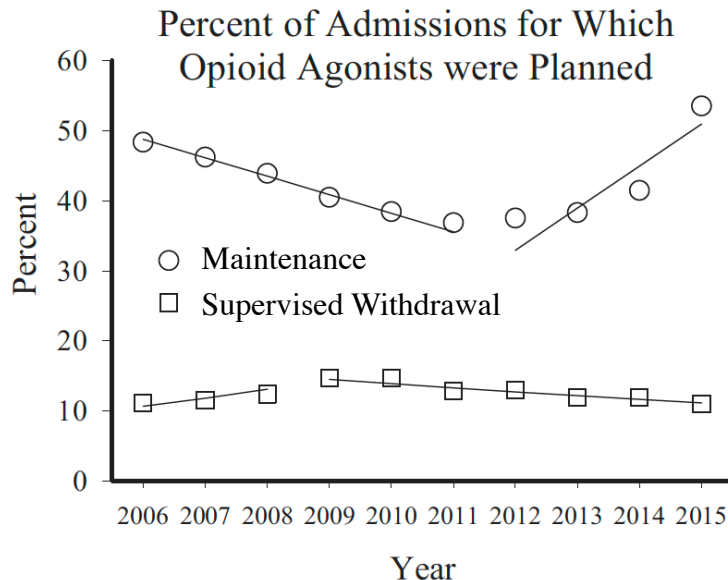
# Supervised Withdrawal Treatment

## Benefits

- Available
- Patient preference
- Continuum of care

## Challenges

- Poor withdrawal management
- Risk of fatal overdose
- No standardization



Most supervised withdrawal programs do not offer opioid medications

# Non-opioid Treatment Options

1521-0103/371/2/422-452\$35.00  
THE JOURNAL OF PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS  
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<https://doi.org/10.1124/jpet.119.258004>  
J Pharmacol Exp Ther 371:422-452, November 2019

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## *Special Section on The Opioid Crisis*

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### Non-Opioid Neurotransmitter Systems that Contribute to the Opioid Withdrawal Syndrome: A Review of Preclinical and Human Evidence

Kelly E. Dunn, Andrew S. Huhn, Cecilia L. Bergeria, Cassandra D. Gipson,  
and Elise M. Weerts

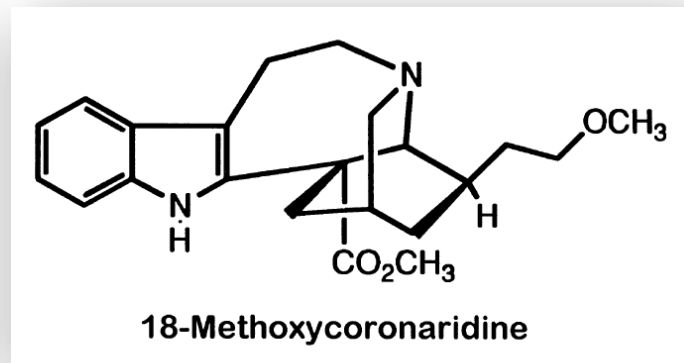
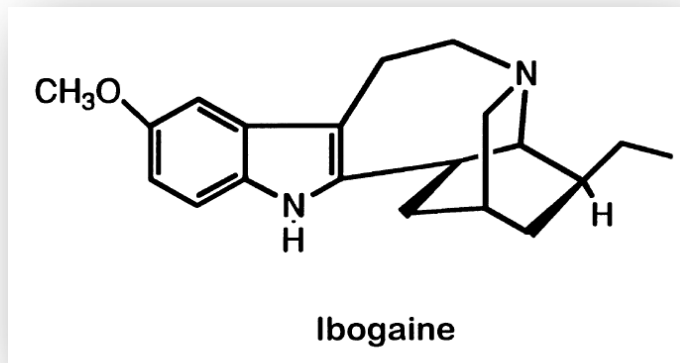
## Ibogaine

- Used internationally
- Efficacy supported by retrospective chart reviews, case studies, and survey studies (no RCTs available)
- Generally administered as a bolus dose for supervised withdrawal
- Narrow therapeutic window, elevated cardiac risk



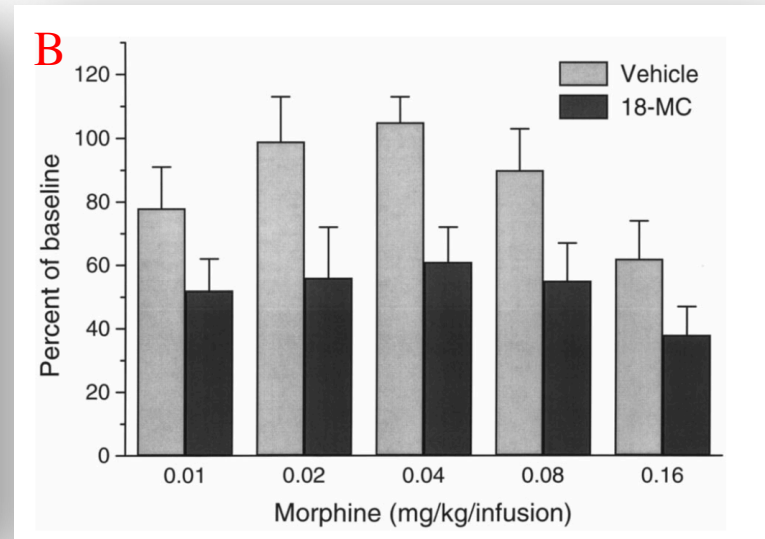
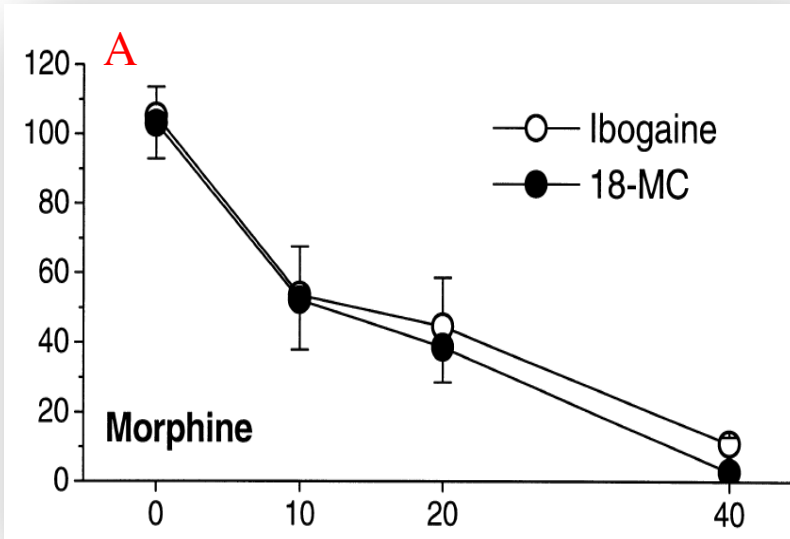
# 18-MC

- Synthetic iboga alkaloid congener, derived from ibogaine
- Different mechanism of action- antagonist on alpha 3, beta 4 nicotinic receptor
- Better safety profile?



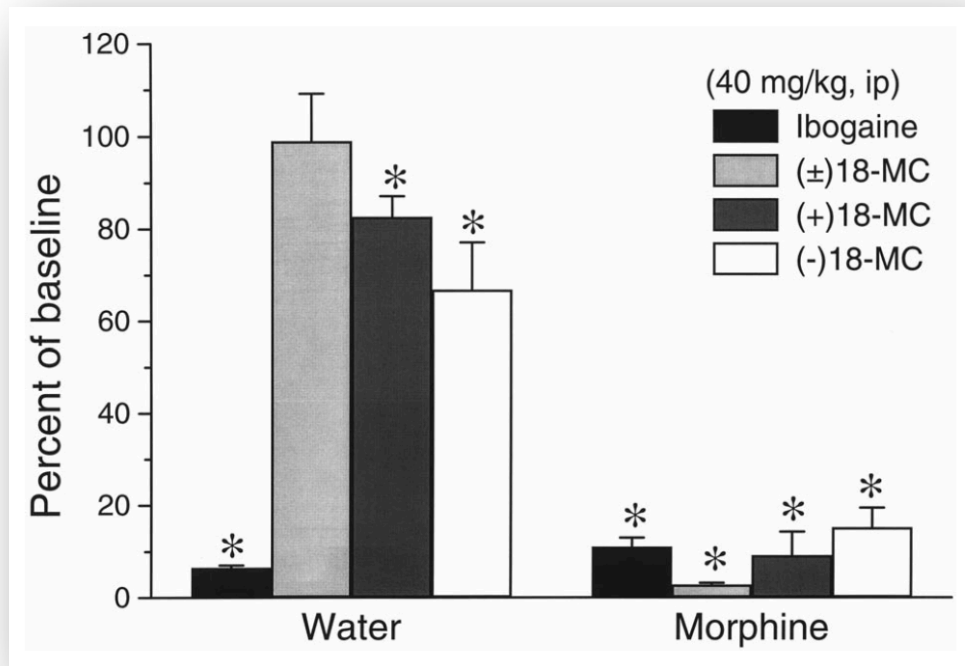
# Reduces Morphine Self-administration

18-MC shifts the dose-response curve for morphine self-administration down, decreasing its efficacy (not potency) relative to (A) Ibogaine and (B) control



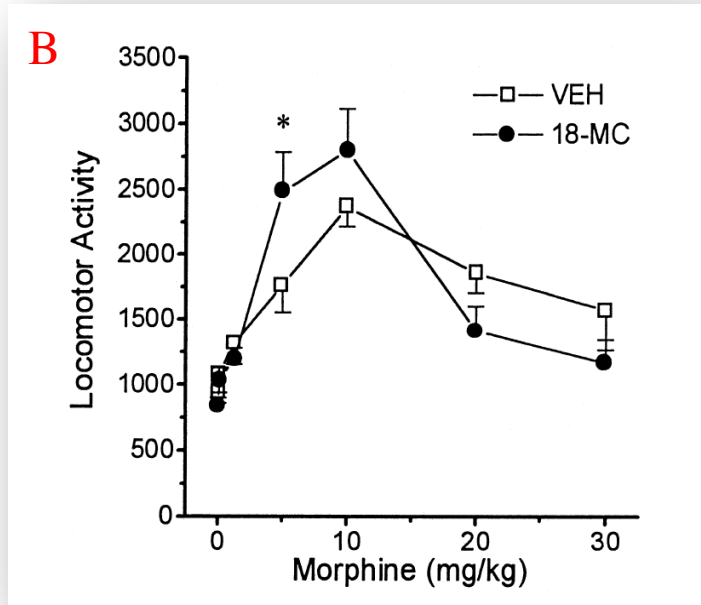
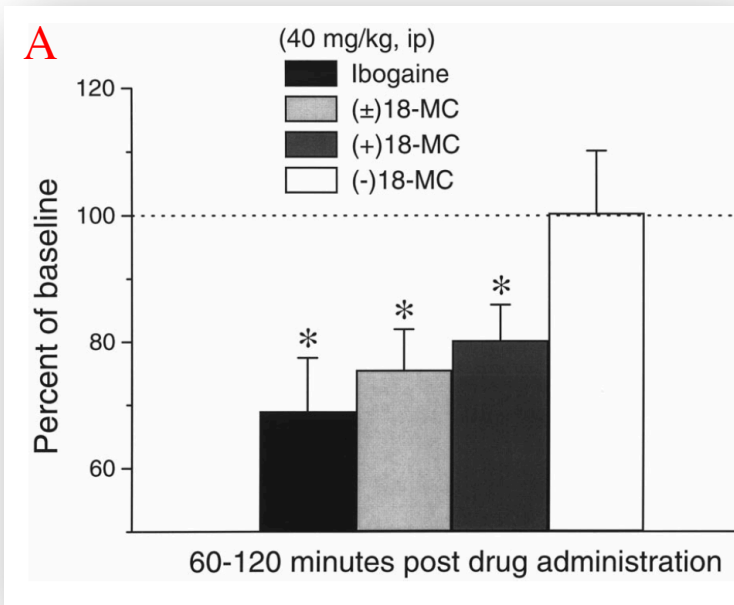
# Maintains Activity on Natural Reinforcers

In contrast to Ibogaine, 18-MC does not reduce responding for a natural reinforcer, suggesting specificity of effects



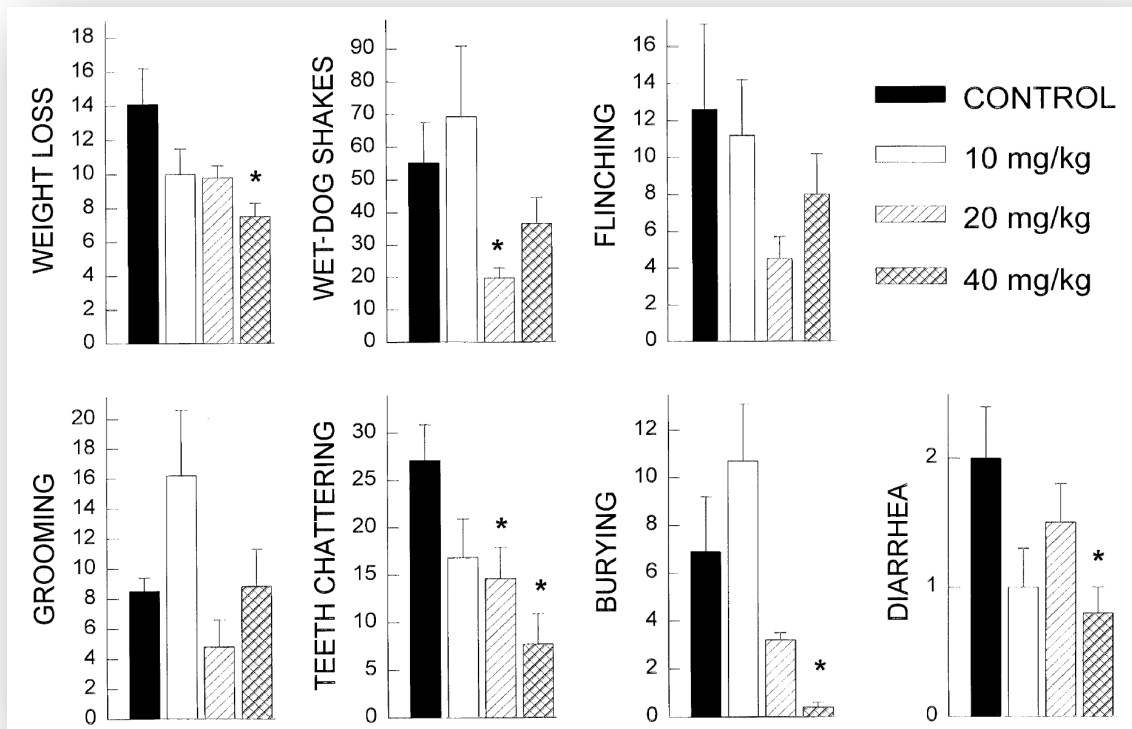
# Reduces Dopamine Release

18-MC decreases (A) extracellular dopamine release in the accumbens and (B) dopamine sensitization following chronic morphine exposure



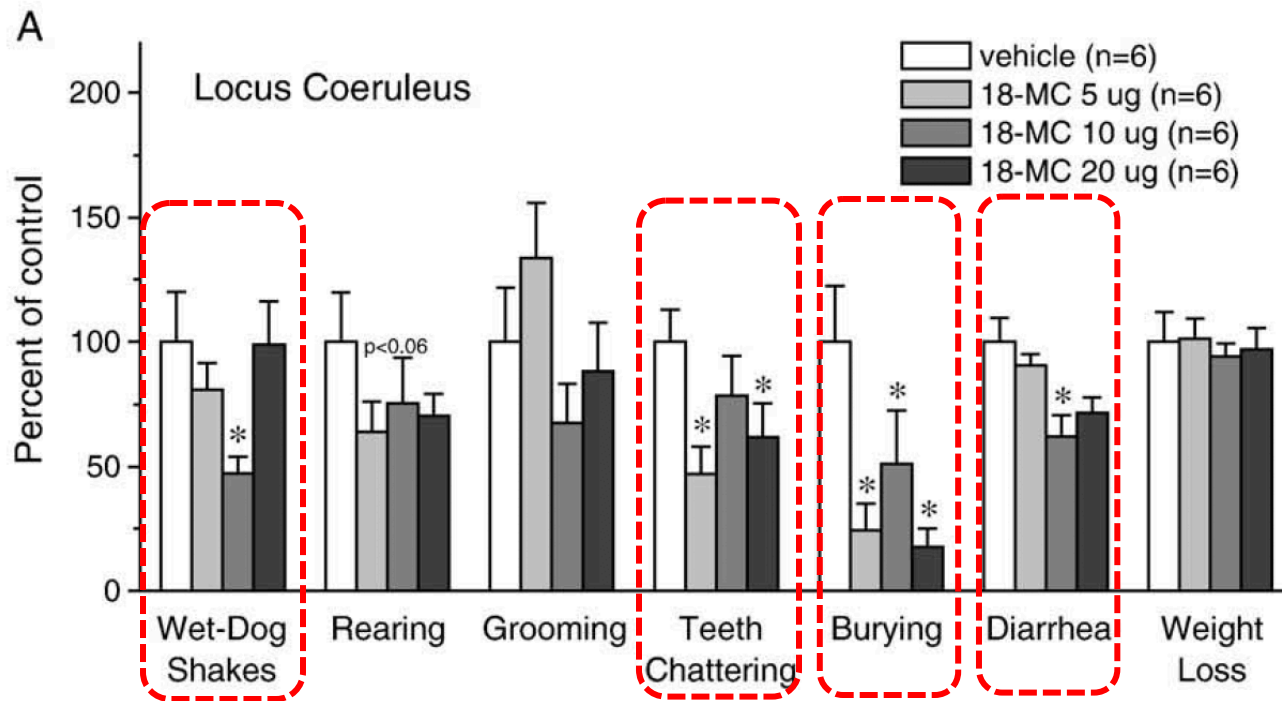
# Reduces Withdrawal Severity

18-MC reduces severity of some withdrawal symptoms (not direct overlap with ibogaine).



# Reduces Withdrawal Severity

Reductions likely driven by locus coeruleus





# Summary

	Ibogaine	18-MC
<b>Primary mechanism of action</b>	Less specific- low affinity agonist on NMDA, 5HT3, sigma-2, serotonin transporter; nicotinic antagonist	More specific- low affinity for opioid receptors and 5-HT3, antagonist at alpha 3 beta 4 nicotinic receptors
<b>Opioid reinforcement</b>	Decreased morphine self-administration	Decreased morphine self-administration
<b>Natural reinforcers</b>	Decreased responding for water	None noted
<b>Withdrawal Severity</b>	Decreases	Decreases, likely driven by activity in locus coeruleus
<b>Adverse effects</b>	Bradycardia; hallucinations; tremors	None noted (TBD?)

# So Why Now?

## **Lofexidine (Lucemyra)**

- Alpha-2 adrenergic agonist
- Approved by FDA in 2018 for indication of “mitigation of opioid withdrawal symptoms”
  - Recognized to not eliminate symptoms
- Not intended as OUD treatment
- Created a new approval pathway and indication

# 18-MC vs. Lofexidine

	18-MC	Lofexidine
Primary mechanism of action	New mechanism of action for OUD: Low affinity for opioid receptors and 5-HT3, antagonist at alpha 3 beta 4 nicotinic receptors	Well-established mechanism of action: Alpha-2 adrenergic agonist (autonomic nervous system)
Efficacy for withdrawal	TBD (supported by preclinical work)	Mild-Moderate (high variability in response) reduction of autonomically- mediated symptoms
Abuse Potential	None recognized	None recognized
Side Effect Profile	(TBD) Appears to be minimal	Bradycardia, mild cardiac risk, dosing adjusted for renal and kidney function
Medication Schedule	TBD (bolus dosing?)	QID, necessary dose taper

# Overall Summary

- There remains a need to identify mechanistically-informed opioid withdrawal medications
- 18-MC may leverage some benefits observed with ibogaine in a safer manner
- Lofexidine established an FDA pathway for approval
- Lofexidine has some weaknesses that may limit its adoption or impact
- A cocktail treatment approach would be preferable

# MM-110

## Zolunicant HCl

### Key Milestones

**Phase 1 Topline Data Readout**

Q2 2022 | Phase 1

**Opioid W/D Study Initiation**

Q2 2022 | Phase 2a

**Opioid W/D ESOE Readout**

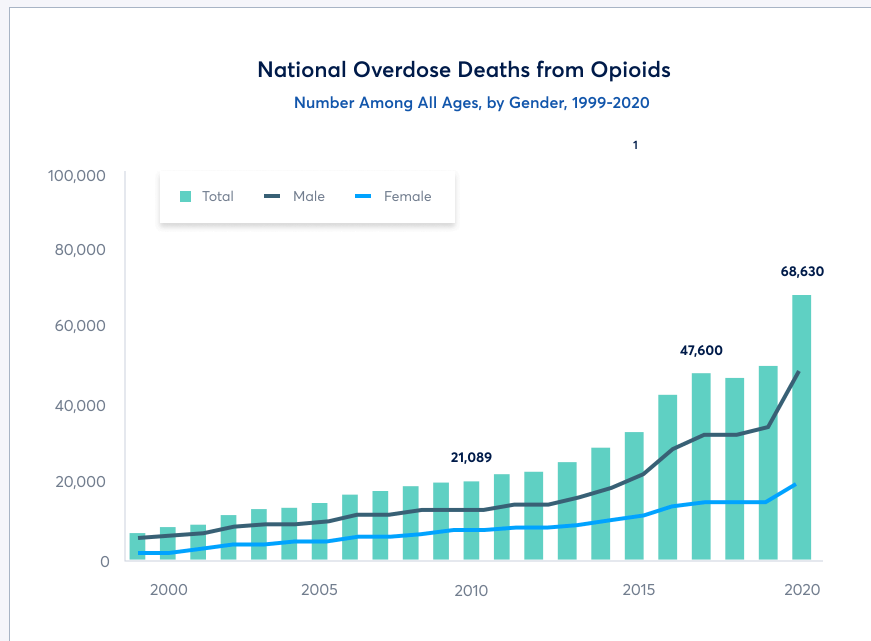
Q1 2023 | Phase 2a (Part A)

ESOE: early sign of efficacy; W/D: withdrawal



# Significant Unmet Need for Opioid Use Disorder (OUD) Treatments

Dangerous relapses during withdrawal period are mediated by withdrawal symptoms



**68,630** people in the US overdosed on opioids in 2020<sup>1</sup>

**225%** increase in opioid overdoses from 2010 to 2020<sup>1</sup>

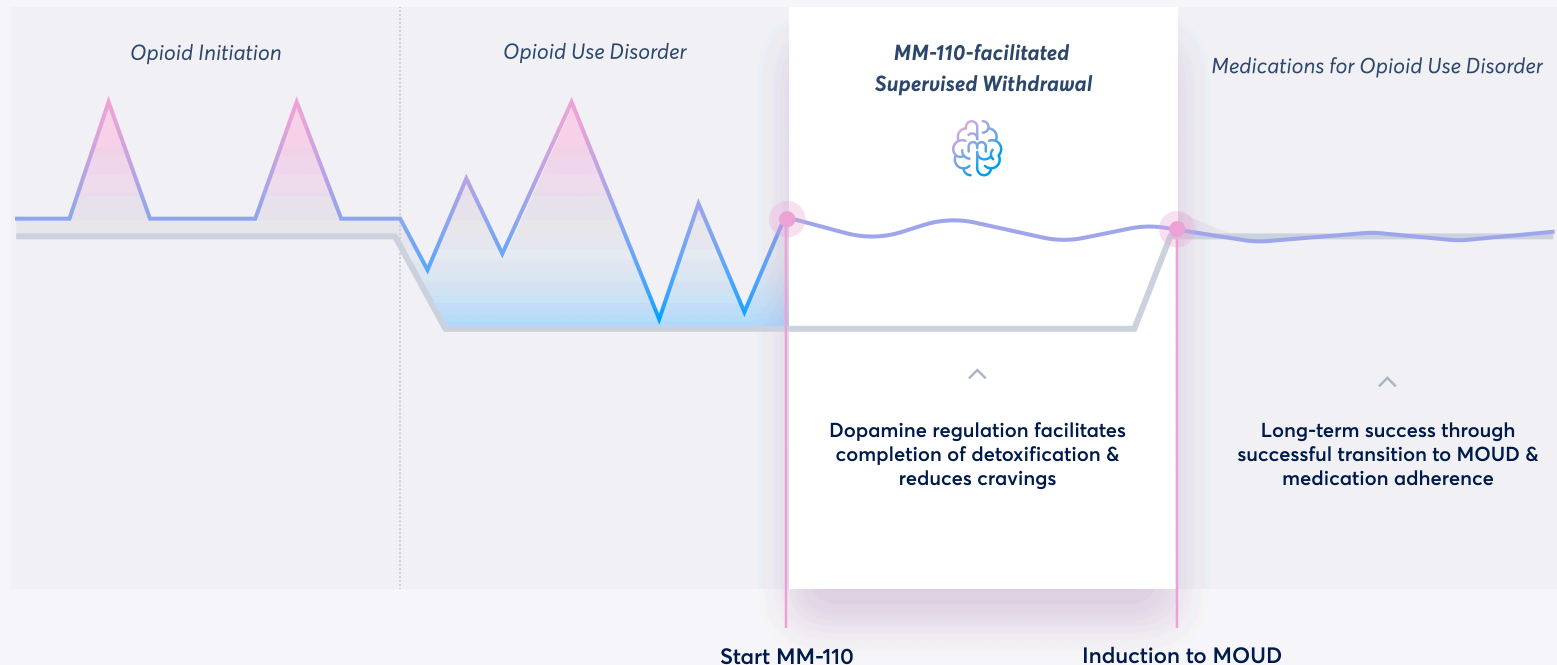
**89%** naltrexone induction failures were early relapses<sup>1</sup>

1. DrugAbuseStatistics.org/opioid-epidemic



# MM-110 | Novel Mechanism to Address a Critical Gap in OUD Treatment

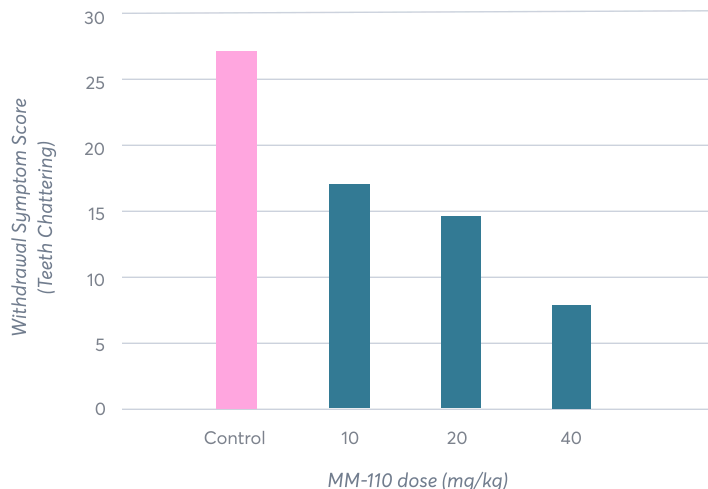
Mechanism of action and target product profile complement standard-of-care and address a critical gap in available treatment landscape



# MM-110 | Strong Preclinical Activity on Key Translational Outcomes

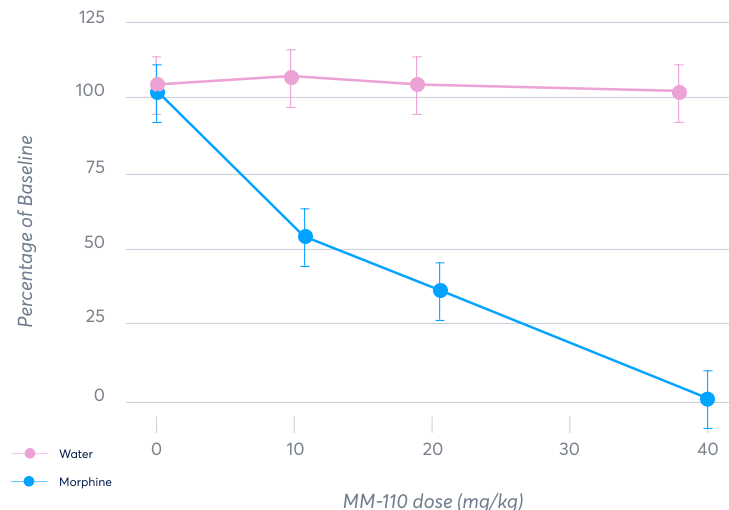
A single dose of MM-110 mitigates withdrawal symptoms and opioid self-administration in preclinical models<sup>1,2</sup>

Reduction in Translational Markers of Opioid Withdrawal in Rats



Source: [1]

Reduction in Translational Markers of OUD in Rats



Source: [2]

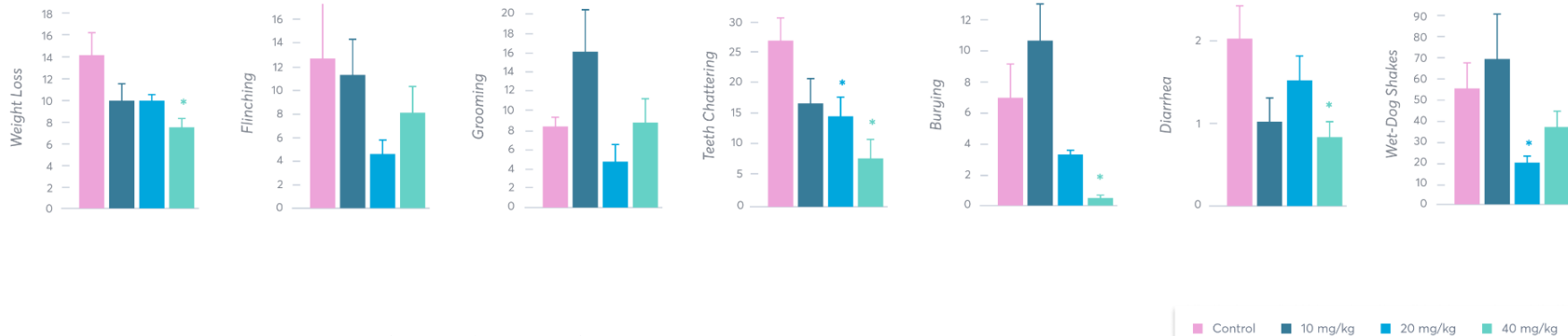
1. Rho & Glick 1998; NeuroReport; 9.

2. Maisonneuve & Glick 2003; Pharmacol Biochem Behav; 75.

# MM-110 | Strong Preclinical Activity on Key Translational Outcomes

A single dose of MM-110 mitigates withdrawal symptoms and opioid self-administration in preclinical models<sup>1,2</sup>

Morphine Withdrawal Following a Single Dose of 10, 20 or 40 mg/kg MM-110 in Rats  
(Rho & Glick 1998) <sup>1</sup>

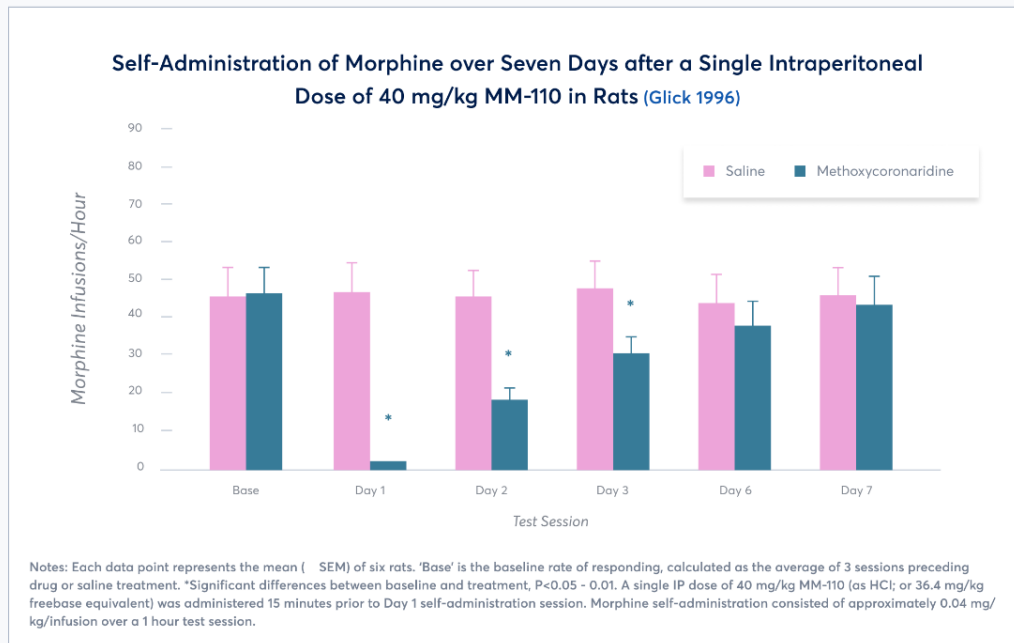


1. Rho & Glick 1998; NeuroReport; 9.

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1. Rho & Glick 1998; NeuroReport; 9.

2. Maisonneuve & Glick 2003; Pharmacol Biochem Behav; 75.

# MM-110 | Phase 1 Study Results - Key Takeaways

*Phase 1 study results support progression of MM-110 (zolunicant) into planned upcoming Phase 2 clinical program*

- **Well-tolerated** up to 500 mg per day in Single Ascending Dose (SAD) and 60 mg per day in the Multiple Ascending Dose (MAD)
- **Linear PK** maintained across the tested doses and frequencies
- **Clinical effects** align with potent CNS engagement
- **QOD regimen** aligns with preclinical evidence & offers potential to be a more effective regimen in opioid withdrawal

# MM-110 | Phase 1 SAD/MAD Dosing Cohorts

Participants received up to 650mg of MM-110 on a single day or were administered up to 180mg/day for seven days or placebo

SUBSTANCE USE DISORDERS

MM-110 (zolunicant HCl; 18-MC)

Indication: Opioid Withdrawal

PHASE 1

Cohort(s)	Zolunicant Dose Group BID	Safety (N=72)	
		Zolunicant n (%)	Placebo n (%)
1	4 mg	5 (6.9)	2 (2.8)
2	8 mg	5 (6.9)	2 (2.8)
3	12 mg	5 (6.9)	2 (2.8)
4	16 mg	5 (6.9)	2 (2.8)
8	25 mg	5 (6.9)	2 (2.8)
9	40 mg	5 (6.9)	2 (2.8)
10	75 mg	5 (6.9)	2 (2.8)
11	150 mg	5 (6.9)	2 (2.8)
12, 15	250 mg	10 (13.9)	4 (5.6)
13	325 mg	1 (1.4)	1 (1.4)
Total:		51 (70.8)	21 (29.2)

Cohort	Zolunicant Dose Group BID x 7 Days	Safety (N=72)	
		Zolunicant n (%)	Placebo n (%)
5	2 mg	5 (13.9)	2 (5.6)
6	5 mg	5 (13.9)	2 (5.6)
7	10 mg	5 (13.6)	2 (5.6)
14	30 mg	5 (13.6)	2 (5.6)
16	90 mg	6 (16.7)	2 (5.6)
Total:		26 (72.2)	10 (27.8)

- SAD well tolerated at doses up to 500mg/day
- MAD well tolerated at doses up to 60mg/day

Source: MindMed internal study documents

# MM-110 | Phase 1 SAD/MAD Adverse Event Tables

Treatment emergent adverse events were mild or moderate in severity and resolved without sequelae

SUBSTANCE USE DISORDERS

MM-110 (zolonicant HCl; 18-MC)

Indication: Opioid Withdrawal

PHASE 1

SOC/PT	Zolonicant x 1 Day n (%)										
	4 mg BID (N=5)	8 mg BID (N=5)	12 mg BID (N=5)	16 mg BID (N=5)	25 mg BID (N=5)	40 mg BID (N=5)	75 mg BID (N=5)	150 mg BID (N=5)	250 mg BID (N=10)	325 mg BID (N=5)	Placebo (pooled) N=21
Any Related TEAE	0	0	1 (20)	1 (20)	2 (40)	0	1 (20)	1 (20)	7 (70)	1 (100)	4 (19)
Eye Disorders	0	0	0	0	0	0	0	0	0	1 (100)	0
Vision Blurred	0	0	0	0	0	0	0	0	0	1 (100)	0
GI Disorders	0	0	0	0	2 (40)	0	1 (20)	0	3 (30)	0	1 (4.8)
Abdominal Distention	0	0	0	0	0	0	1 (20)	0	0	0	0
Abdominal Pain	0	0	0	0	0	0	0	0	1 (10)	0	1 (4.8)
Nausea	0	0	0	0	2 (40)	0	0	0	3 (30)	0	0
Vomiting	0	0	0	0	0	0	0	0	1 (10)	0	0
General Disorders & Admin. Site Conditions	0	0	0	0	0	0	0	0	0	1 (100)	0
Fatigue	0	0	0	0	0	0	0	0	0	1 (100)	0
Musculoskeletal & Connective Tissue Disorders	0	0	0	0	0	0	0	0	2 (20)	0	0
Limb Discomfort	0	0	0	0	0	0	0	0	1 (10)	0	0
Muscle Tightness	0	0	0	0	0	0	0	0	1 (10)	0	0
Nervous System Disorders	0	0	1 (20)	1 (20)	2 (40)	0	0	1 (20)	6 (60)	1 (100)	2 (9.5)
Ataxia	0	0	0	0	0	0	0	0	0	1 (100)	0
Disturbance in Attention	0	0	0	0	0	0	0	0	0	1 (100)	0
Dizziness	0	0	0	1 (20)	1 (20)	0	0	0	4 (40)	0	2 (9.5)
Headache	0	0	1 (20)	0	1 (20)	0	0	1 (20)	0	0	1 (4.8)
Presyncope	0	0	0	0	0	0	0	0	1 (10)	0	0
Visual Perseveration	0	0	0	0	0	0	0	0	1 (10)	0	0
Psychiatric Disorders	0	0	0	0	1 (20)	0	0	0	0	0	1 (4.8)
Abnormal Dreams	0	0	0	0	0	0	0	0	0	0	1 (4.8)
Bradyphrenia	0	0	0	0	1 (20)	0	0	0	0	0	0

SOC/PT	Zolonicant x 1 Day n (%)					
	4 mg BID (N=5)	5 mg BID (N=5)	10 mg BID (N=5)	30 mg BID (N=5)	90 mg BID (N=5)	Placebo (pooled) N=21
Any Related TEAE	0	2 (40)	0	2 (40)	5 (83.3)	1 (10)
Eye Disorders	0	0	0	0	1 (16.7)	1 (10)
Blepharospasm	0	0	0	0	0	1 (10)
Visual Impairment	0	0	0	0	1 (16.7)	0
GI Disorders	0	1 (20)	0	2 (40)	2 (33.3)	1 (10)
Musculoskeletal & Connective Tissue Disorders	0	0	0	0	0	1 (10)
Muscle Twitching	0	0	0	0	0	1 (10)
Nervous System Disorders	0	1 (20)	0	1 (20)	1 (16.7)	1 (10)
Dizziness	0	1 (20)	0	0	0	0
Headache	0	0	0	1 (20)	1 (16.7)	0
Muscle Contractions Involuntary	0	0	0	0	0	1 (10)
Paraesthesia	0	0	0	1 (20)	0	0
Psychiatric Disorders	0	1 (20)	0	0	3 (50)	0
Abnormal Dreams	0	1 (20)	0	0	0	0
Anhedonia	0	0	0	0	1 (16.7)	0
Depressed Mood	0	0	0	0	1 (16.7)	0
Mania	0	0	0	0	1 (16.7)	0

Note: SOC and PT were assigned using MedDRA version 23.0. Multiple events in the same SOC and PT were counted only once at each level of summation. Percentages were based on the number of subjects in the Safety population.

Related refers to the Investigator's assessment that the TEAE was possibly, probably, or had a highly probable relatedness to the study drug.



# MM-110 | Phase 1 SAD/MAD Adverse Event Summaries

Across the SAD and MAD cohorts, only 5 TEAE led to discontinuation of MM-110 and there were no serious adverse events

SUBSTANCE USE DISORDERS

MM-110 (zolonicant HCl; 18-MC)

Indication: Opioid Withdrawal

PHASE 1

	Zolonicant BID x 1 day n (%)									
	4 mg (N=5)	8 mg (N=5)	12 mg (N=5)	16 mg (N=5)	25 mg (N=5)	40 mg (N=5)	75 mg (N=5)	150 mg (N=5)	250 mg (N=10)	325 mg (N=1)
TEAE	1 (20)	0	2 (40)	2 (40)	4 (80)	2 (40)	4 (80)	3 (60)	10 (100)	1 (100)
Related TEAE	0	0	1 (20)	1 (20)	2 (40)	0	1 (20)	1 (20)	7 (70)	1 (100)
Drug withdrawn due to TEAE	0	0	0	0	0	0	0	0	1 (10)	1 (100)

	Zolonicant BID x 7 day n (%)					
	2 mg (N=5)	5 mg (N=5)	10 mg (N=5)	30 mg (N=5)	90 mg (N=5)	Placebo (pooled) N=21
TEAE	4 (80)	5 (100)	5 (100)	5 (100)	6 (100)	8 (80)
Related TEAE	0	2 (40)	0	2 (40)	5 (83.3)	1 (10)
Drug withdrawn due to TEAE	0	0	0	0	4 (66.7)	0

- Clinical laboratory parameters and electrocardiograms were assessed with no findings of clinical concern across the administered dose ranges

Related refers to the Investigator's assessment that the TEAE was possibly, probably, or had a highly probable relatedness to the study drug.

Source: MindMed internal study documents



MindMed



# MM-110 | Phase 1 SAD PK Curve

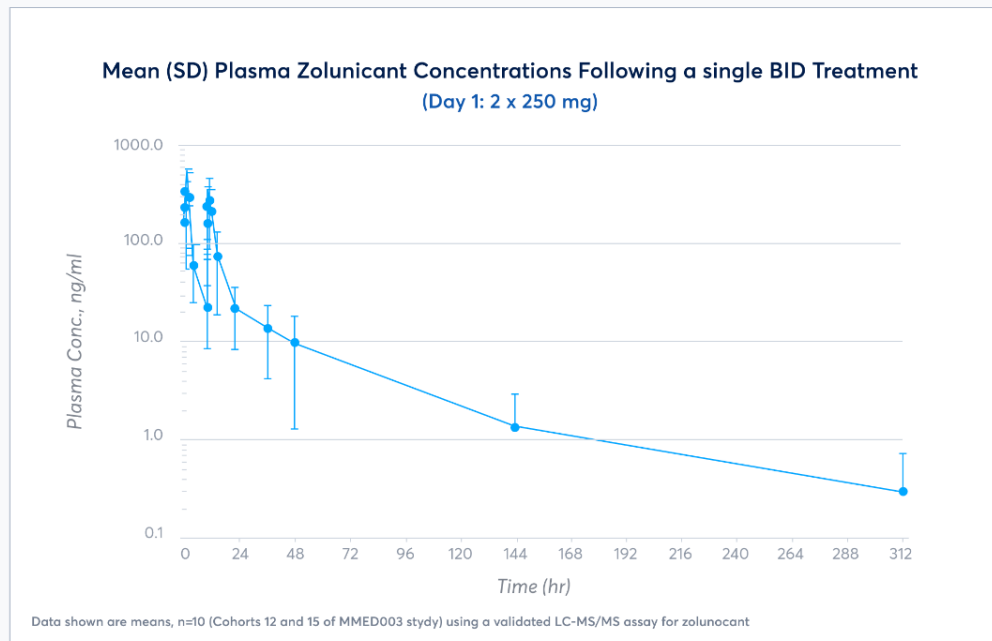
A linear pharmacokinetic profile was observed even at the highest doses

SUBSTANCE USE DISORDERS

MM-110 (zolunicant HCl; 18-MC)

Indication: Opioid Withdrawal

PHASE 1



Source: MindMed internal study documents

ESOE: early sign of efficacy; POC: proof of concept; QOD: Every Other Day (dosage timing); SOWS: Subjective Opiate Withdrawal Scale



MindMed

# MM-110 | Phase 1 MAD Comparison PK Curve

The pharmacokinetic profile was maintained across the tested doses and SAD/MAD dosing schedules.

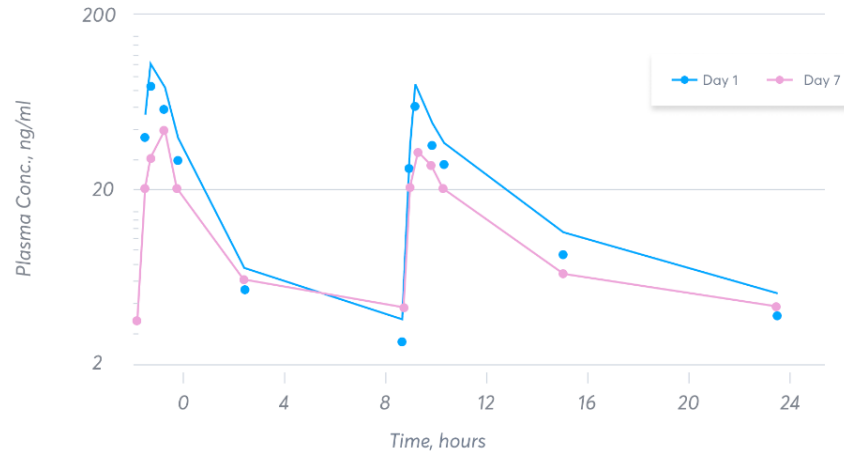
SUBSTANCE USE DISORDERS

MM-110 (zolunicant HCl; 18-MC)

Indication: Opioid Withdrawal

PHASE 1

Comparison of Mean Plasma Zolunicant Concentration Profiles on Day 1 and Day 7 during Multiple Dosing with Zolunicant at 30 mg BID (60 mg/day)



Data shown are means, n=5 (Cohort 14 of Study MMED003) using validated LC-MS/MS assay for zolunicant

Source: MindMed internal study documents

ESOE: early sign of efficacy; POC: proof of concept; QOD: Every Other Day (dosage timing); SOWS: Subjective Opiate Withdrawal Scale



MindMed

# MM-110 | Phase 2a Supervised Withdrawal in Opioid Use Disorder

Gated two-part study design provides opportunity for early signs of efficacy (ESOE) and informs randomized proof of concept design

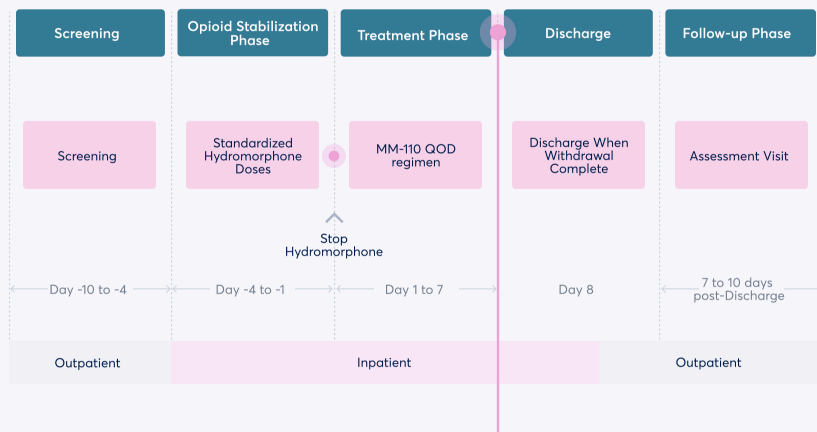
SUBSTANCE USE DISORDERS

MM-110 (zolunicant HCl; 18-MC)

Indication: Opioid Withdrawal

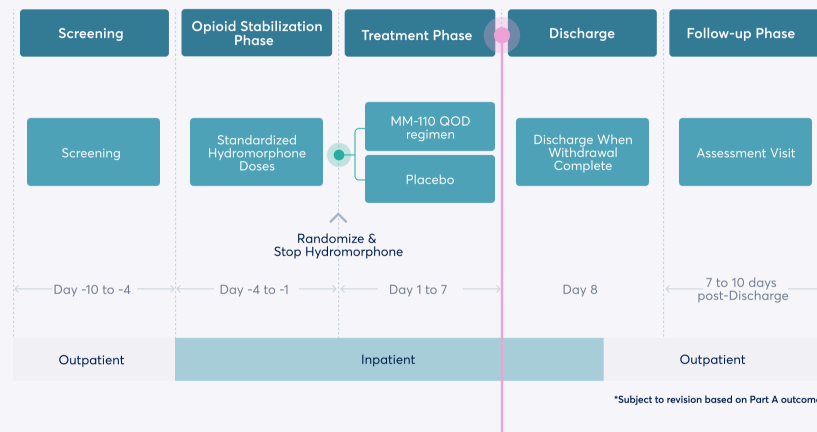
PHASE 2A

## Part A | Open-Label Early Sign of Efficacy in Opioid Withdrawal (n=10)



**Primary Endpoint**  
Mean SOWS-Gossop score over first 5 days of Treatment Phase

## Part B | Randomized Placebo-Controlled POC in Opioid Withdrawal (n=42/arm\*)



\*Subject to revision based on Part A outcomes

**Primary Endpoint**  
Mean SOWS-Gossop score over first 5 days of Treatment Phase

Source: MindMed internal study documents

ESOE: early sign of efficacy; POC: proof of concept; QOD: Every Other Day (dosage timing); SOWS: Subjective Opiate Withdrawal Scale



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# Q&A