### The 2 x 4 Model

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Figure 2

A  Epidemiological Evidence

Mental Illness  
Addiction

Dual Diagnoses

B  Behavioral Health System Built Against the Evidence

Population with mental illness

Population with Addiction

Mental Health Care System
psychiatric hospitals, clinics, private psychiatrists

Addiction Treatment System
detox centers, rehabs 12-step Groups

Segregation
Figure 4

A. Pre-adolescent/prodromal Mental Illness

B. Post-adolescent/Adult Mental Illness

C. Addiction Pathogenesis

D. Addiction Acceleration in Mental Illness
A. Pre-adolescent/Prodromal Mental Illness. Genetic factors and environmental experiences (e.g. childhood trauma) impact the form and function of temporal-limbic neurons and network connectivity, spanning amygdala (AMY) and ventral hippocampal (VH) regions symbolized by blue neurons and axonal projections.  

B. Post-Adolescent/Adult Mental Illness. By adulthood many forms of major mental illness that produce addiction vulnerability (e.g. schizophrenia, personality disorders, post-traumatic stress spectrum disorders, unipolar and bipolar illness) show broader prefrontal-cortical (PFC) and temporal-limbic (AMY/VH) involvement, symbolized by blue neurons and axo-dendritic structures spanning all these regions. The anatomical spreading of illness involvement may differ in scope and mechanism across different types of mental illness, but probably involves different degrees of i) disturbances in peri-adolescent synaptic pruning of local dendritic arborizations in the PFC (symbolized by decreased dendritic complexity of pyramidal neurons and cortical thinning); ii) dysregulation of hippocampal neurogenesis (puffy blue hippocampal neurons); iii) worsening alterations in local AMY neuronal physiology (puffy blue AMY neurons); and iv) alterations in the formation of long range axo-dendritic connectivity between PFC/AMY/VH, not to mention a host of finer irregularities involving key neurotransmitter and neurohormonal systems. In any case, a disturbances of PFC/AMY/VH network structures and function are expected to have convergent, down steam effects on nucleus Accumbens (NAC) network form and function, and the motivational information the NAC network represents. Because all of these structures directly project into the NAC, motivational control, learning and memory are dependent on all these structures; a greater scope and severity of the PFC/AMY/VH involvement in the mental illness (e.g. more severe the mental illness) generally produce greater disturbances in motivated behavior.  

C. Addiction Pathogenesis. Repeated use of addictive drugs (symbolized by red zig zag in the VTA-Dopamine pathways into the NAC, produces a host of neuroplastic effects impacting the shape, connectivity, and information processing of NAC neurons (symbolized by red colorization of some NAC cell bodies, dendrites and axonal (GABAergic) projections to downstream pallidal and thalamic structures). These NAC network changes, represent changes in the encoded motivational repertoire such that motivations to seek out and use addictive drug(s), are involuntarily promoted, or become increasingly dominant at the expense of normal motivations that drive healthy social, occupational, and neurovegetative behaviors.  

D. Addiction Acceleration in Mental Illness. In the context of an underlying mental illness, especially in the adolescent neurodevelopmental phase (as the mental illness is progressing from A to B), the biological, disease causing impact of addictive drugs on the NAC-based neural network (shown as a milder form in C) is more severe and happens with greater temporal speed (acceleration of diseases process) in D. Thus, fewer doses of the addictive drug are needed to entrain a greater contribution of the NAC network (and associated down stream dorsal striatal structures required for habit formation) into driving drug-seeking and taking behavior, at the expense of an already impoverished and dysfunctional motivational-behavioral repertoire. Thus, the motivational network vulnerability caused by mental illness (blue structures), amplifies and accelerates the NAC network impact of addictive drugs (red structures) that drives a relatively greater proportion of motivational encoding of addictive over healthy behavior.
The 4-Quadrant Model

A
The 4-Quadrant Model
Original: discrete categories

B
The 4-Quadrant Model
Modified: spectrum severity

C
2 x 4 Model: Illness Dimension

Figure 5
Figure 6

Mental Illnesses
- Schizophrenia
- Schizoaffective
- Depression spectrum
- Bipolar spectrum
- OCD spectrum
- Impulse control spectrum
- PTSD (trauma spectrum)
- Anxiety spectrum
- Borderline
- Antisocial
- Narcissistic
- Others

Substance Use Disorders
- Nicotine
- Alcohol
- Opioids
- Benzodiazepines
- Marijuana
- Cocaine
- Methamphetamine
- Solvents
- Synthetics
- Others
Figure 8

Diagnostics

Psychiatric Evaluation
MI Clinical Rating Scales
Vitals
Medical Tests

Required & Routine

1. Addiction Psychiatry (Dual DX) Evaluation
2. Objective Drug Testing
   - Rapids
   - Send Outs/Chromatography
   - Breathylizer (ETOH)
   - CO monitor
3. PDMP Data
4. Treatment Encounter Tracking
   - Group Tx
   - Individual Tx
   - Psychiatric Detox
   - Psychiatrist
5. Clinical Rating Scales
   - Folstein
   - COWS
   - CIWA
   - ACES
   - SOGS
6. Medical Assessment
   - Weight
   - Vitals
   - Blood Testing
   - PG tests

Mental Health

Addictionology

Addiction Hx
SUD Clinical Rating Scales
Objective Drug Testing
PDMP Data
Figure 9

Psychotherapies

Individual Therapies
Supportive
CBT
IPT
Psychodynamic

Group Therapies
12 Step Approaches
Educational
MET
Contingency Management

Required & Routine

1. Flexible, personalized deployment of individual and group therapies
2. MET and CBT foundation to all therapies
3. Attention to Stages of Change for with respect to dual diagnosis comorbidities and psychotherapeutic focus
4. Supplementation with Psychodynamic, IPT, 12-Step, Contingency Management and Experiential approaches
1. Design flexible, individualized combination regimens of both MI and SUD medications.

2. Maintain attention to minimalism, non-redundancy and parsimony.

3. Inform regimen design based on the best available science.

4. Focus on starting and ending medication trials based on the clinical case evidence.

5. Avoid addictive drug polypharmacy

6. Avoid long-term use of reinforcing meds for MI indications
Communications

Addiction Psychiatrists
Therapists
Case Managers
Nursing

Required & Routine

1. Criminal Justice System
   - right to treatment
   - right to employment
   - right to family unification

2. General Health Care System
   - pharmacological interdiction
   - C/L Addiction psychiatry
   - right to insurance coverage

3. Economic System
   - transportation
   - housing
   - employment
   - disability income

4. Social—Family Support System
   - family
   - friends
   - cohabitants

Addictionology

Mental Health

Phone
Regular Mail
EMR
Email
Face to face
A. Behavioral Health: 3rd Quarter 20th Century

B. ‘War on Drugs’ and De-institutionalization

C. Pulverization and Collapsing of Behavioral Health

D. Revitalization via 2 x 4 Model Clinical System

Figure 12. A. By 1975, behavioral health was still composed of a relatively strong infrastructure and professional workforce although addictionology and mental health were largely un-integrated. B. With progression of the war on drugs and de-institutionalization, more mentally ill/addicted people became criminalized and behavioral health became more fragmented, losing infrastructure, workforce, and funding. C. These trends outpaced advances in neuroscience and psychopharmacology, contributing to overgrowth of the mass incarceration industry and the non-behavioral health focused medical-industrial complex. Unsustainable growth of the social and economic costs of mass incarceration and highly interventional medical care aimed at illnesses and injuries resulting from untreated addictions and mental illness, became an auto-reinforcing dynamic, driving further degradation and fragmentation of behavioral health. D. Implementing widespread integration of Mental health and Addiction treatment through building a 2 x 4 Model Clinical system could significantly strengthen the clinical effectiveness, reach, and efficiency of behavioral health. 2 x 4 Model System Communications and collaborations with Criminal justice and Non-behavioral Health Care systems, will create much greater cost and mission effectiveness of those systems, allowing their economies to be appropriately sized to sustainable levels, while generating a higher level of public health and well-being.
The 2 x 4 Model: Horizontal Binding

Treatment Dimension
- Diagnostics
- Psychotherapies
- Medications
- Communications

Illness Dimension
- Mental Illness
- Addiction
The 2 x 4 Model: 2 Dimensional Binding
Figure 15

Points of Attack in 2 x 4 Model Treatment

Direct:
- Targeting MI

Indirect:
- Targeting Effects of SUD To Drive MI

Direct:
- Targeting SUD

Indirect:
- Targeting Effects of MI To Drive SUDS
The 2 x 4 Model & Addiction Psychiatry ACGME Milestones

**Vertical and Horizontal Binding Milestones**

- **MK1.** Clinical Neuroscience (neuroanatomy, physiology and neuropharmacology) *(Chapters 2, 4, 5, 6, 7)*
- **MK2.** Psychopathology (comorbidities, illness trajectories, epidemiology) *(Chapters 2, 4, 5, 6, 7)*
- **SBP1.** Patient Safety and the Health Care Team *(Chapters 5, 6, 7, 8, 9, 10)*
- **SBP2.** Resource Management *(Chapters 5, 6, 7, 8, 9, 10)*
- **PBLI1.** Lifelong learning *(Chapters 2, 11)*
- **PBLI2.** Teaching *(Chapters 2, 11)*
- **PROF1.** Compassion, integrity, respect, sensitivity, ethics *(Chapters 6, 8, 10)*
- **PROF2.** Accountability to Self, patients colleagues and profession *(Chapters 8, 9, 10, 11, 12)*
- **ICS1.** Relationship development/conflict management *(Chapters 8, 9, 10, 11)*
- **ICS2.** Information sharing and record keeping *(Chapters 3, 4, 5, 8, 10)*
Figure 17. Guided replication and geographical spread of a system of 2 x 4 Model Clinics across a region or state over several years. Academic 2 x 4 Model Clinics founded in University towns could provide training, staffing support and fidelity monitoring to Developing 2 x 4 Model Clinics in proximity. These Developing clinics would be started in existing Community Mental Health Centers, Addiction Treatment programs, or Psychiatric Hospital and Rehabs center that want to become fully Dual Diagnosis capable and expand into longitudinal outpatient missions according to the 2 x 4 Model Design.