The 2 x 4 Model

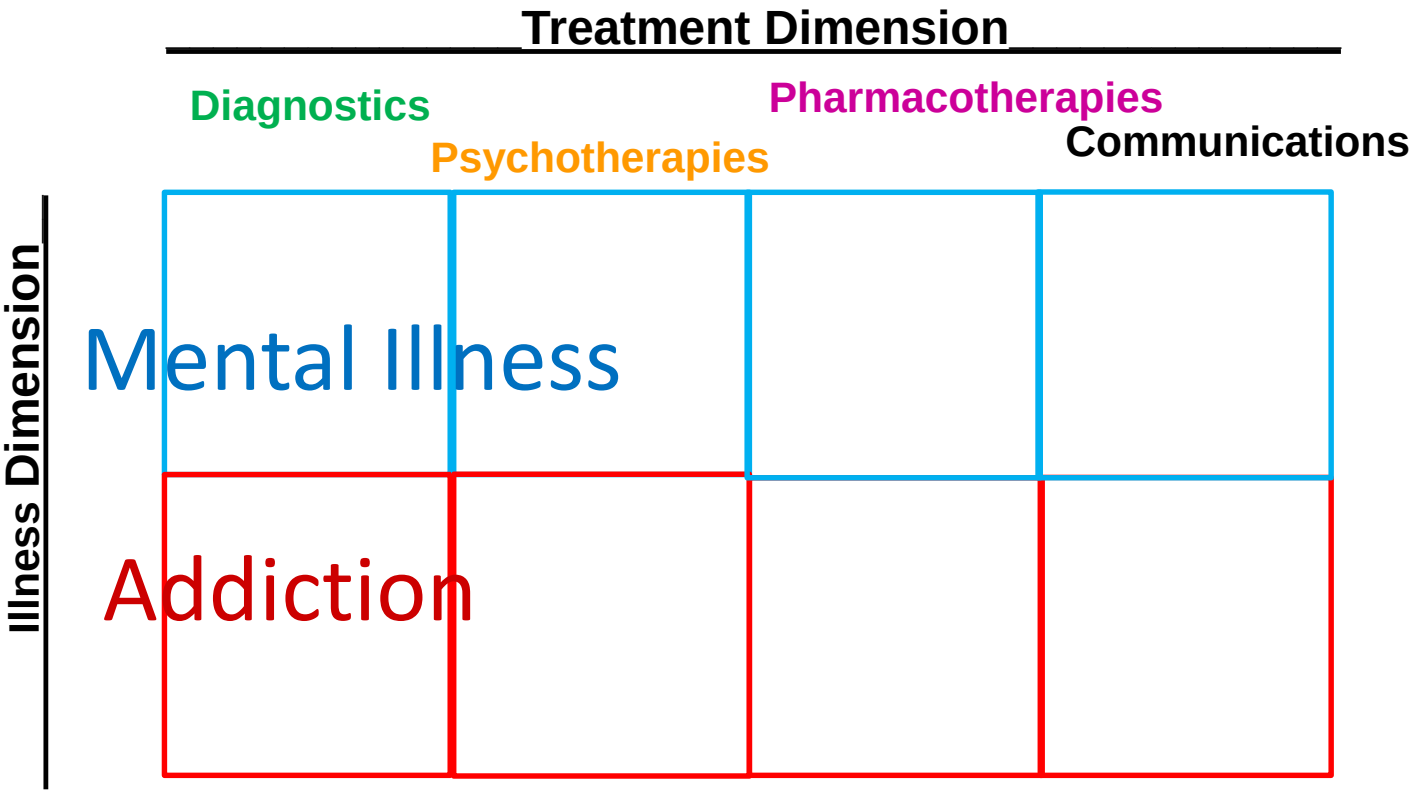


Figure 2

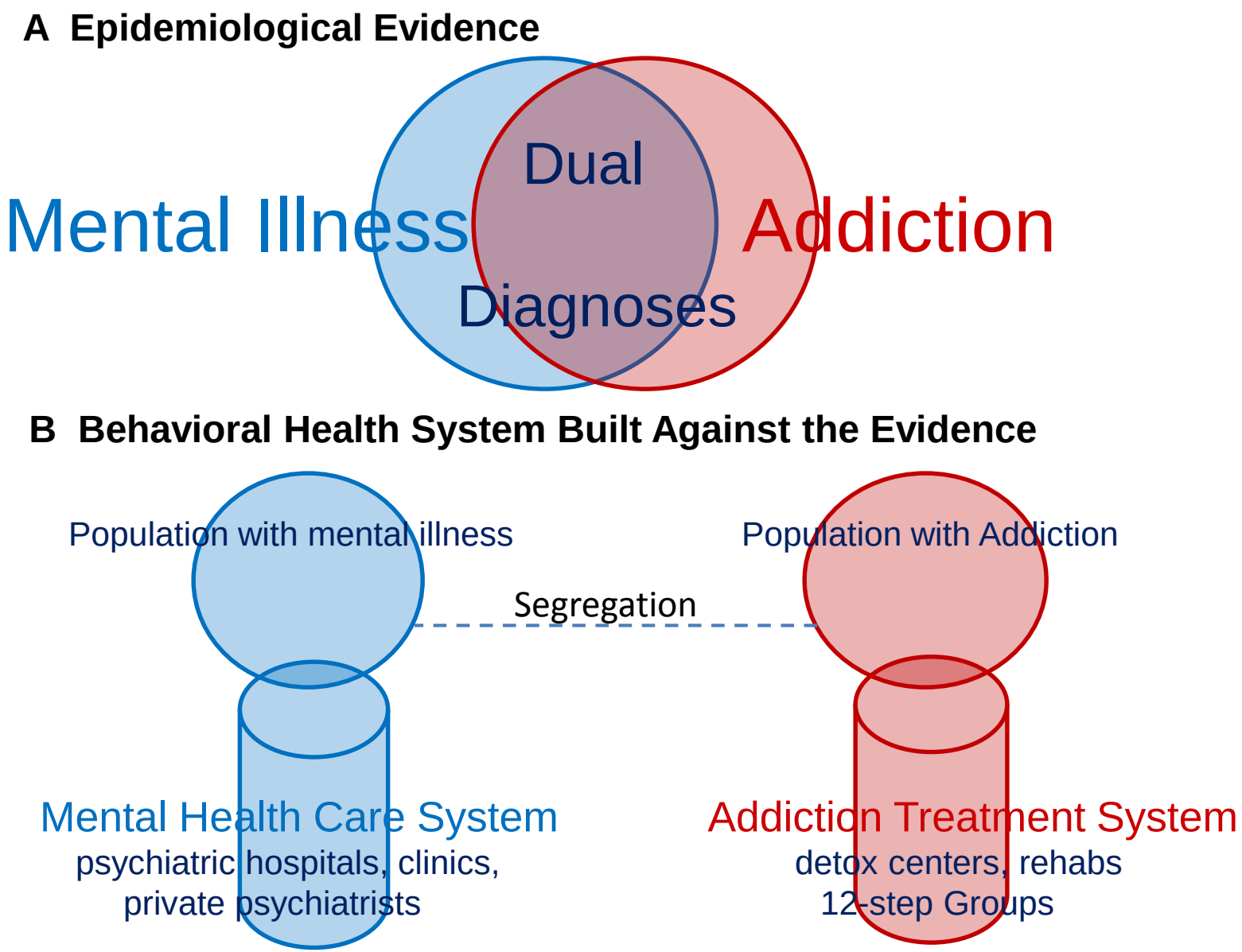

A Epidemiological Evidence
Mental Illness
Dual
Diagnoses
Addiction
B Behavioral Health System Built Against the Evidence
Population with mental illness
Segregation
Population with Addiction
Mental Health Care System
psychiatric hospitals, clinics,
private psychiatrists
Addiction Treatment System
detox centers, rehabs
12-step Groups

Figure 3

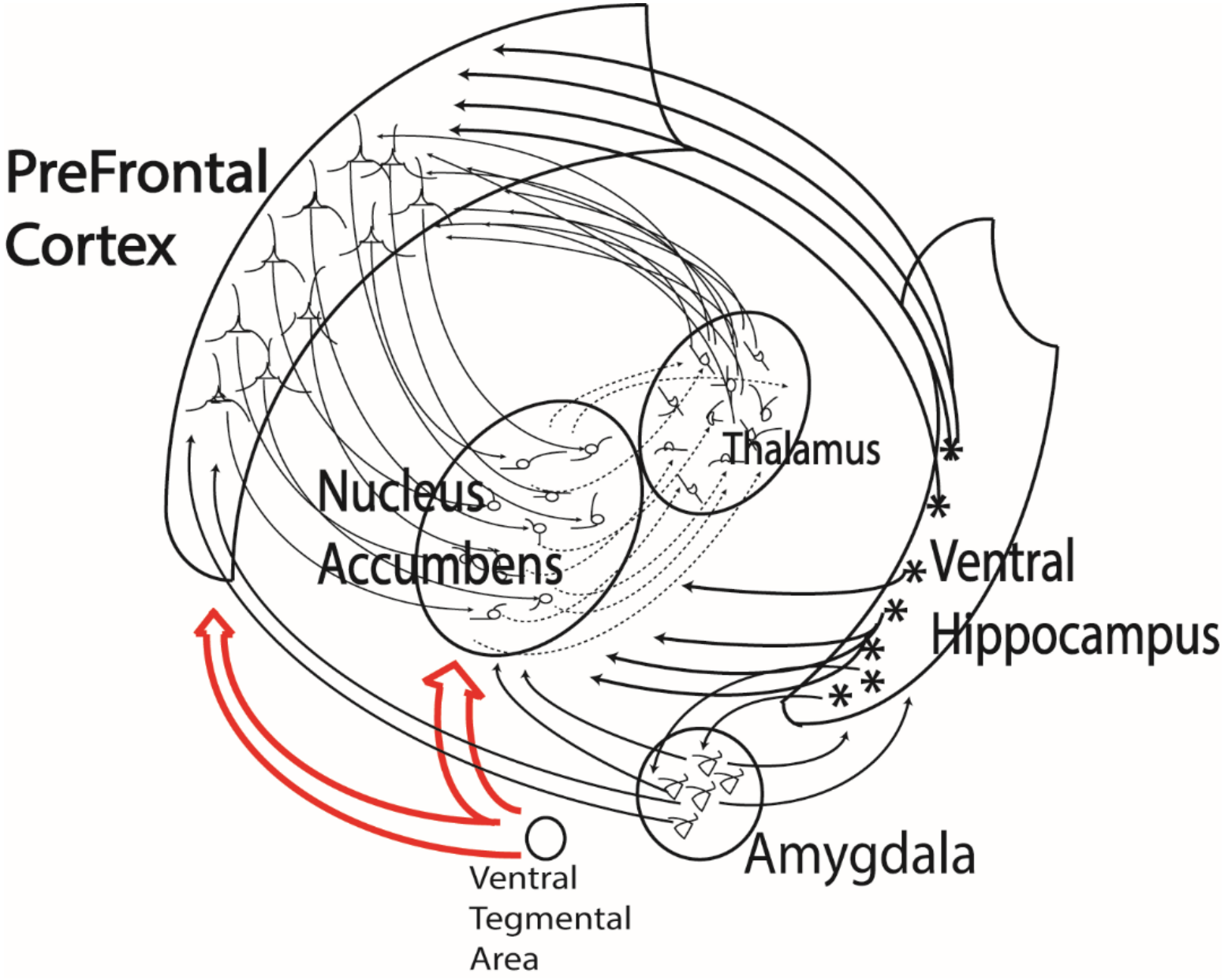

PreFrontal
Cortex
Thalamus
Nucleus
Accumbens
Ventral
Hippocampus
Amygdala
Ventral
Tegmental
Area

Figure 4

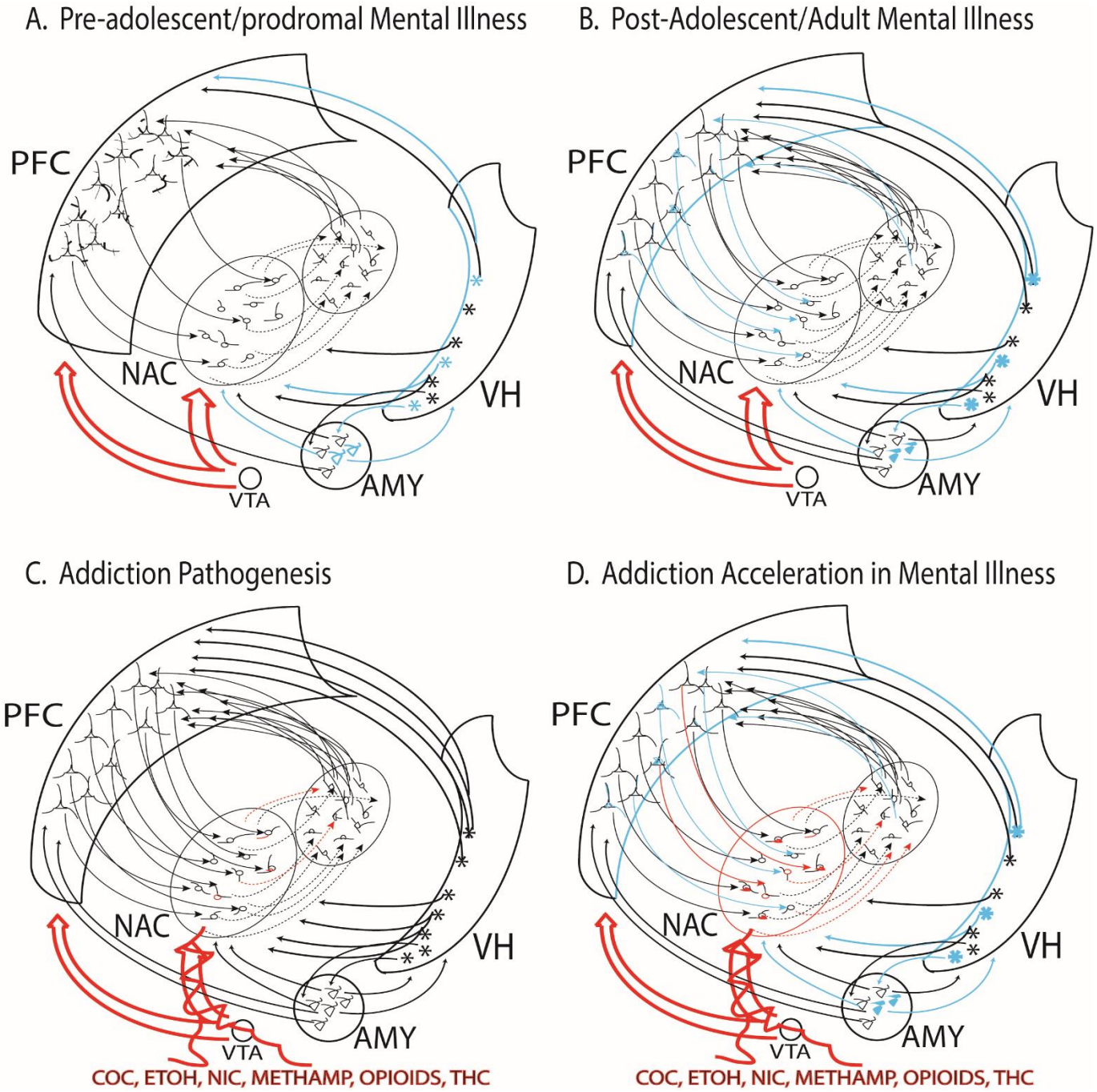

A. Pre-adolescent/prodromal Mental Illness
PFC
NAC
VH
VTA
AMY
B. Post-Adolescent/Adult Mental Illness
PFC
NAC
VH
VTA
AMY
C. Addiction Pathogenesis
PFC
NAC
VH
VTA
AMY
COC, ETOH, NIC, METHAMP, OPIOIDS, THC
D. Addiction Acceleration in Mental Illness
PFC
NAC
VH
VTA
AMY
COC, ETOH, NIC, METHAMP, OPIOIDS, THC

Figure 4 Caption (on page opposite to Figure 4 ABCD, which should occupy entire page space)

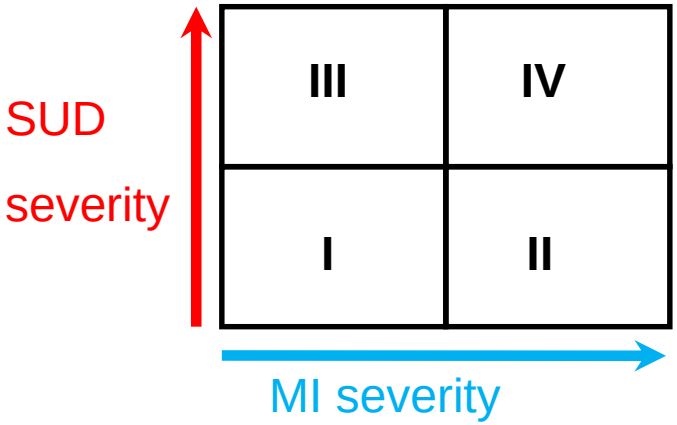
A. Pre-adolescent/Prodromal Mental illness. Genetic factors and environmental experiences (e.g. childhood trauma) impact the form and function of temporal-limbic neurons and network connectivity, spanning amygdala (AMY) and ventral hippocampal (VH) regions symbolized by blue neurons and axonal projections.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

Figure 5

A

The 4-Quadrant Model

Original: discrete categories



B

The 4-Quadrant Model

Modified: spectrum severity

C

2 x 4 Model:
Illness Dimension

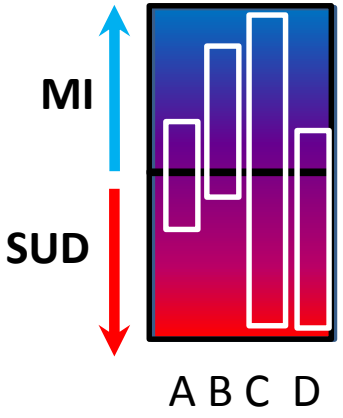


Figure 6

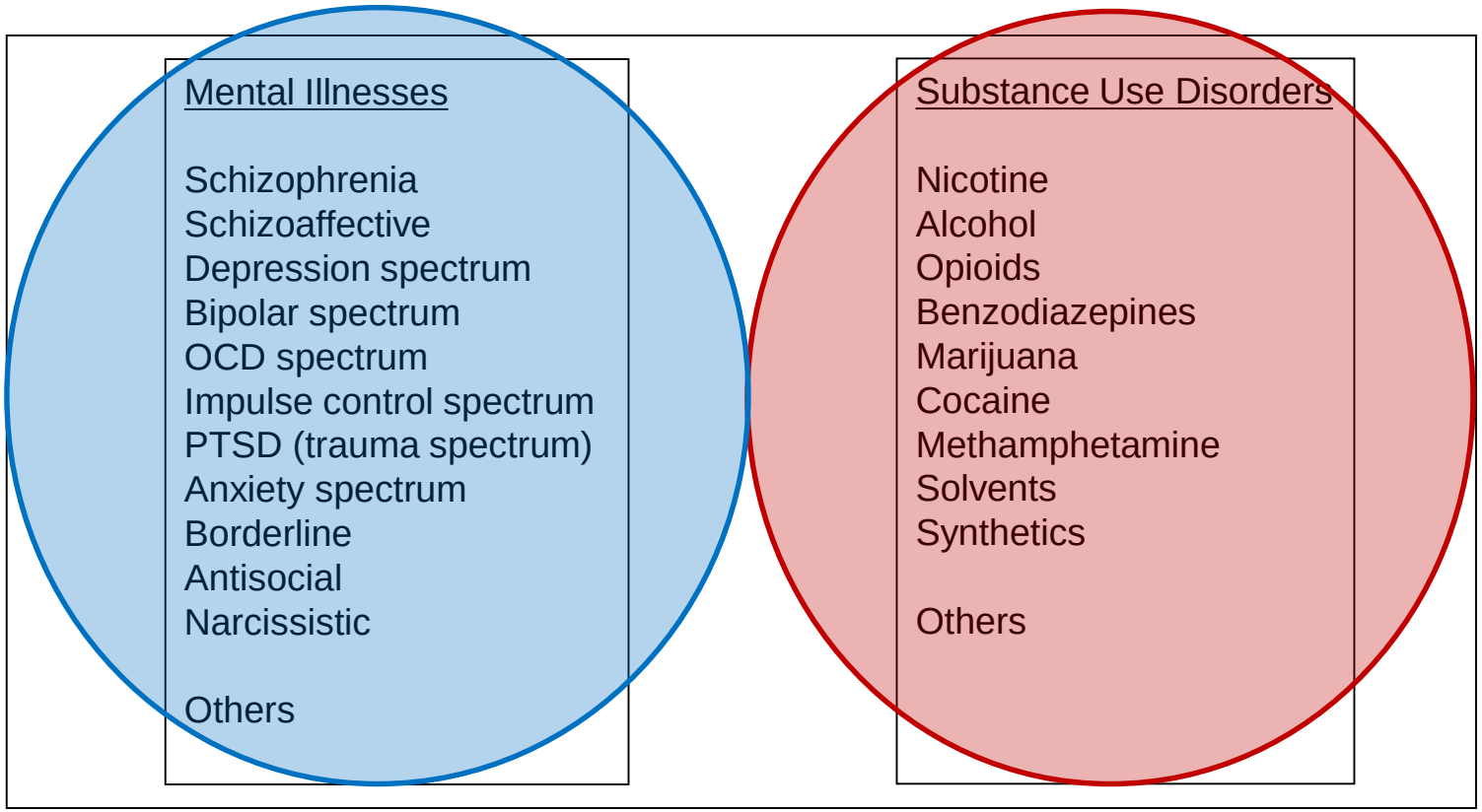

Mental Illnesses
Schizophrenia
Schizoaffective
Depression spectrum
Bipolar spectrum
OCD spectrum
Impulse control spectrum
PTSD (trauma spectrum)
Anxiety spectrum
Borderline
Antisocial
Narcissistic
Others
Substance Use Disorders
Nicotine
Alcohol
Opioids
Benzodiazepines
Marijuana
Cocaine
Methamphetamine
Solvents
Synthetics
Others

Figure 7

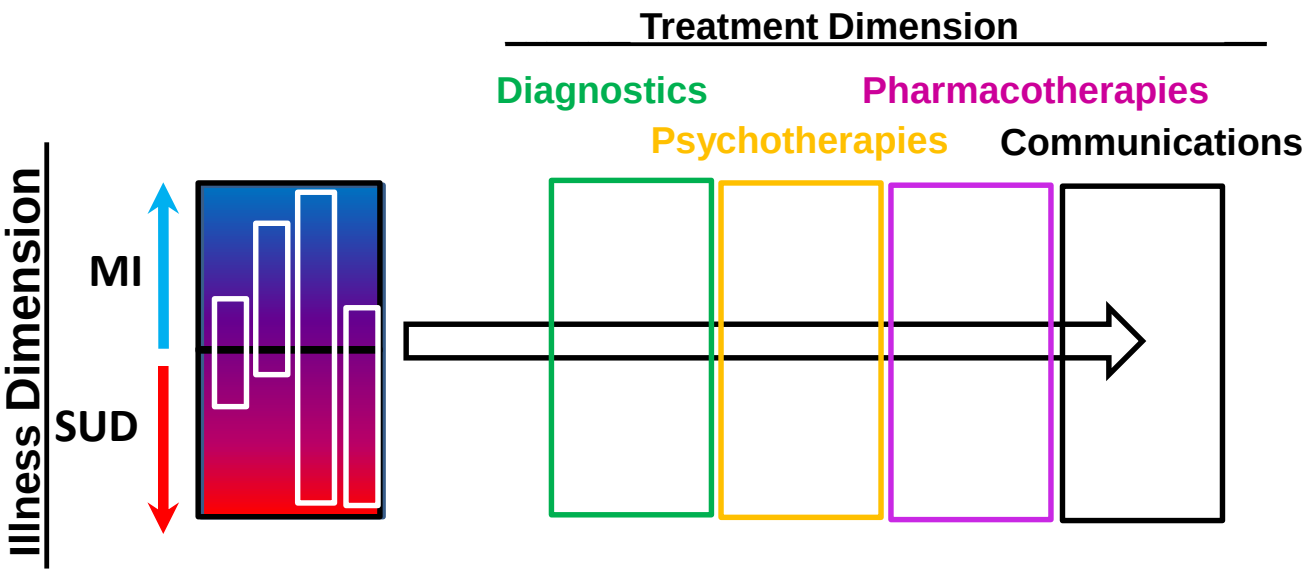

Treatment Dimension
Diagnostics
Pharmacotherapies
Psychotherapies
Communications
Illness Dimension
MI
SUD

Figure 8

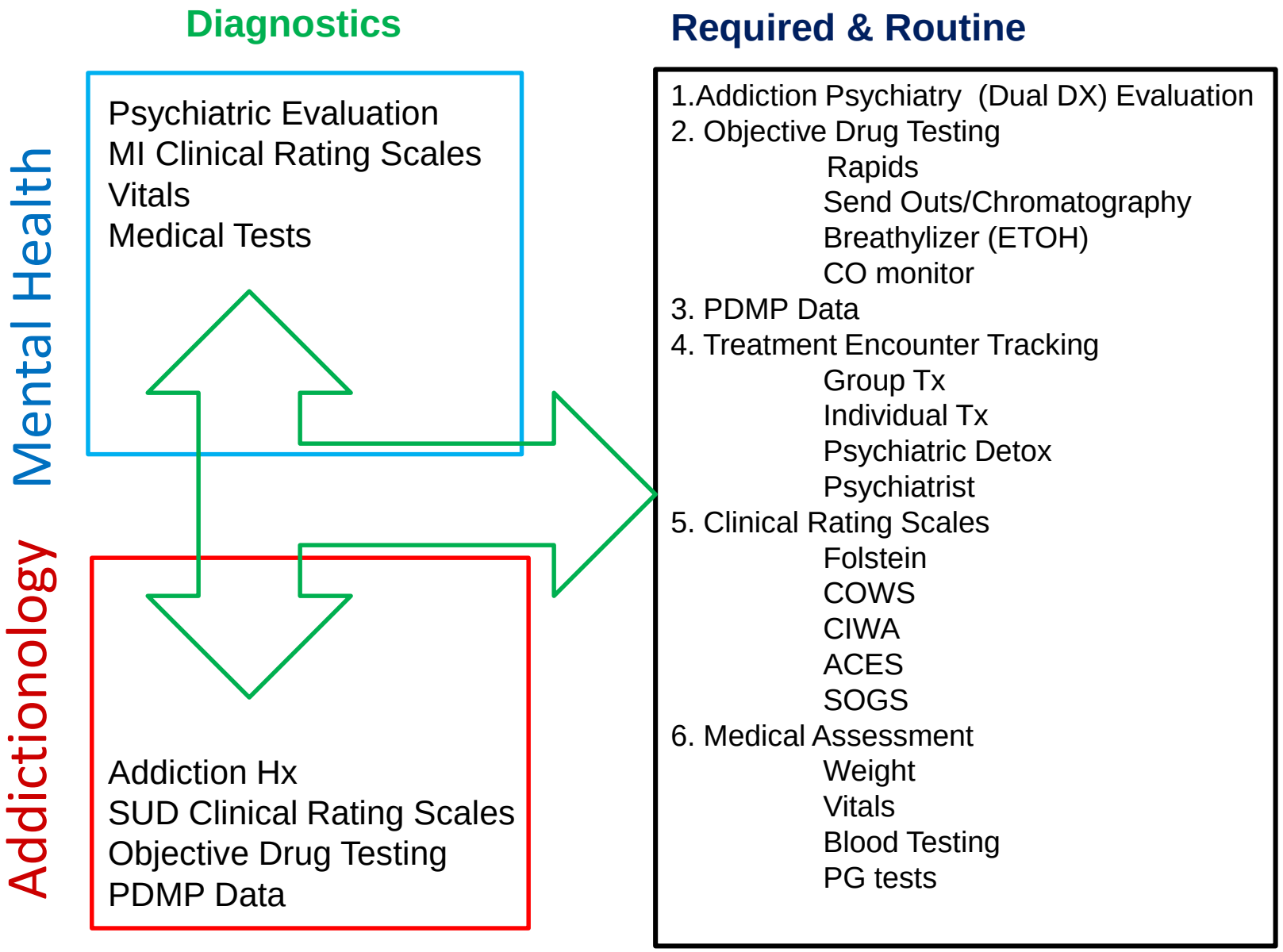

Diagnostics
Required & Routine
Mental Health
Addictionology
Psychiatric Evaluation
MI Clinical Rating Scales
Vitals
Medical Tests
Addiction Hx
SUD Clinical Rating Scales
Objective Drug Testing
PDMP Data
1.Addiction Psychiatry (Dual DX) Evaluation
2. Objective Drug Testing
Rapids
Send Outs/Chromatography
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

Figure 9

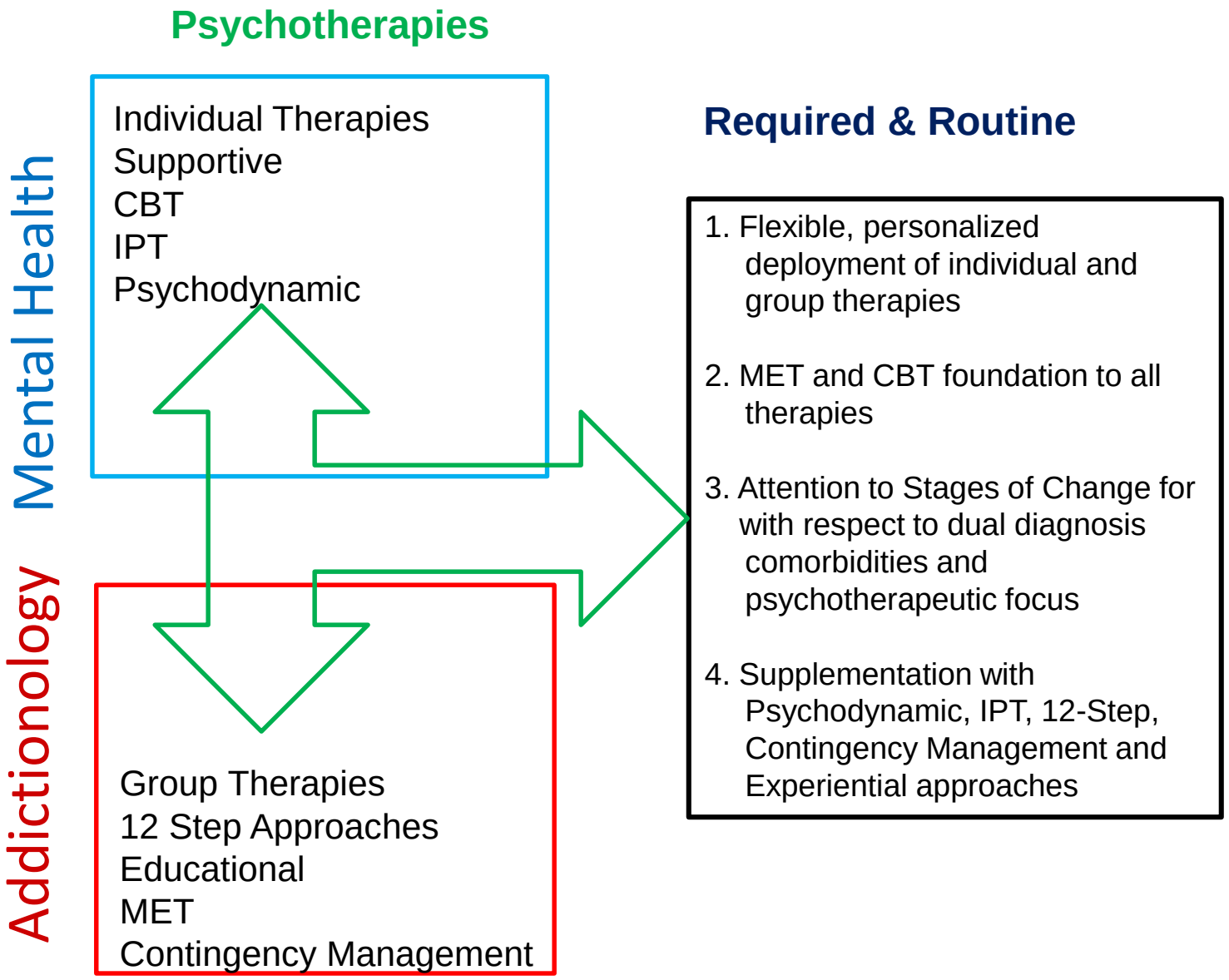

Psychotherapies
Individual Therapies
Supportive
CBT
IPT
Psychodynamic
Mental Health
Addictionology
Group Therapies
12 Step Approaches
Educational
MET
Contingency Management
Required & Routine
1. Flexible, personalized deployment of individual and group therapies
2. MET and CBT foundation to all therapies
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

Figure 10

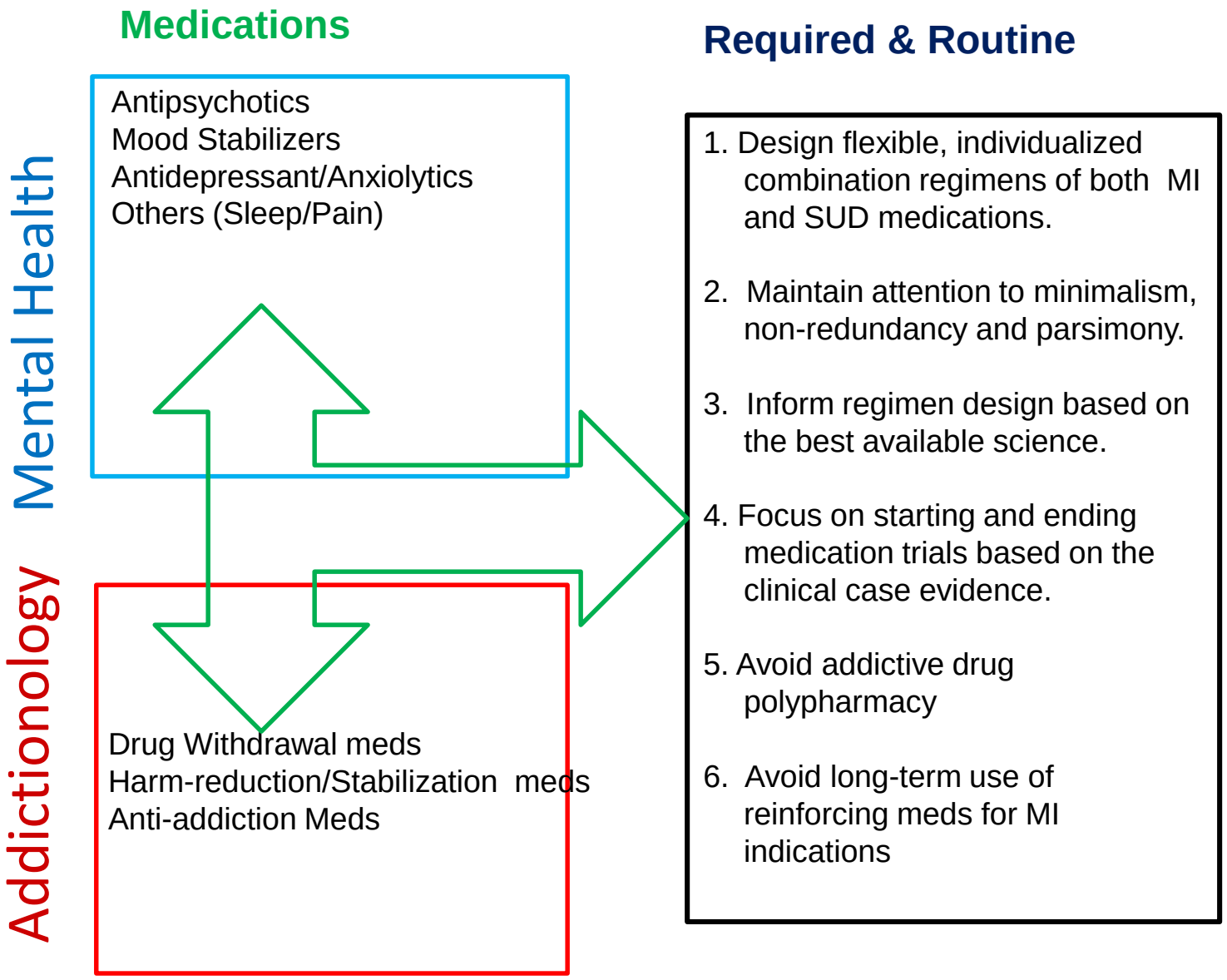
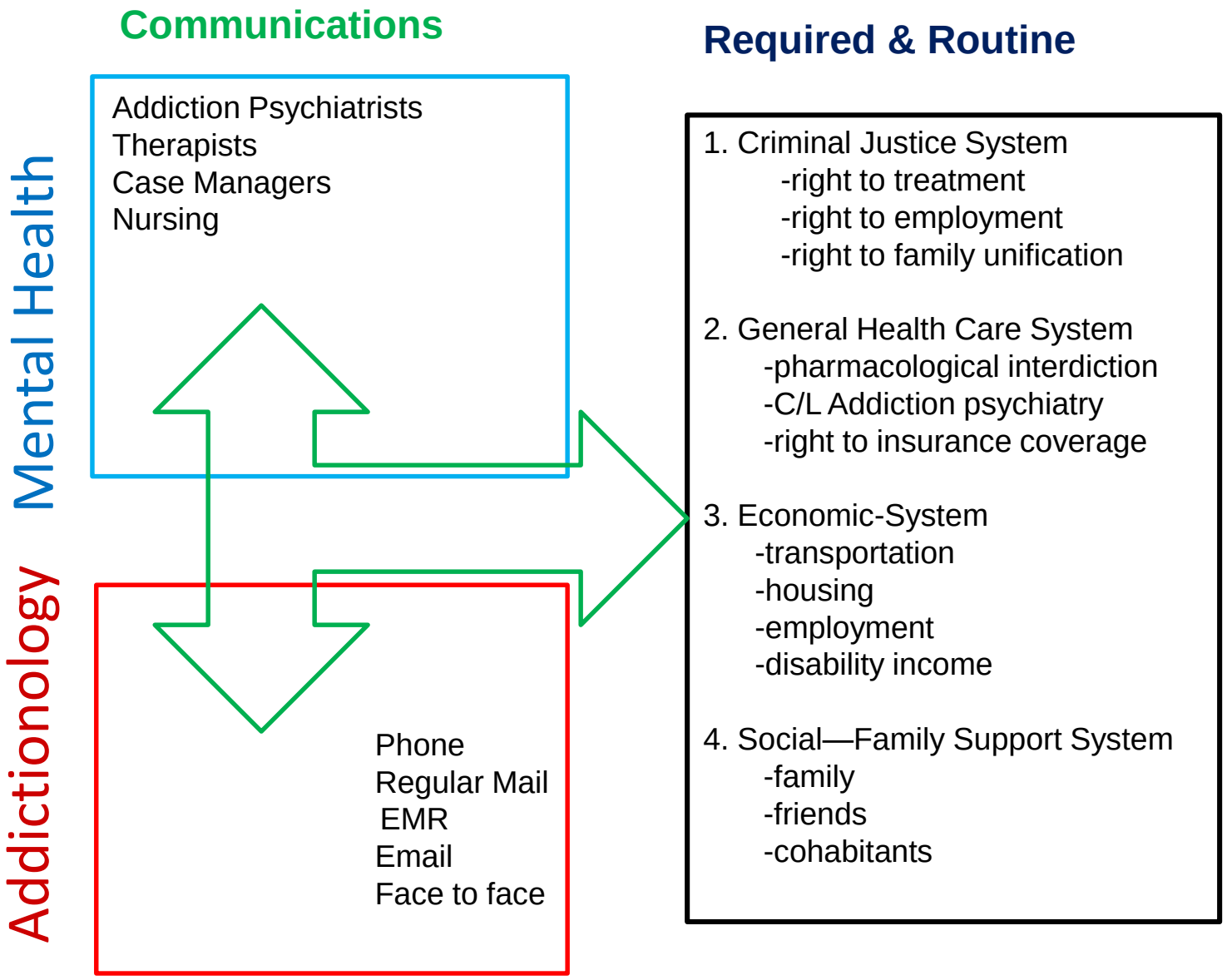

Medications
Required & Routine
Mental Health
Addictionology
Antipsychotics
Mood Stabilizers
Antidepressant/Anxiolytics
Others (Sleep/Pain)
Drug Withdrawal meds
Harm-reduction/Stabilization meds
Anti-addiction Meds
1. Design flexible, individualized combination regimens of both MI and SUD medications.
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

Figure 11


Communications
Required & Routine
Addiction Psychiatrists
Therapists
Case Managers
Nursing
Mental Health
Addictionology
Phone
Regular Mail
EMR
Email
Face to face
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

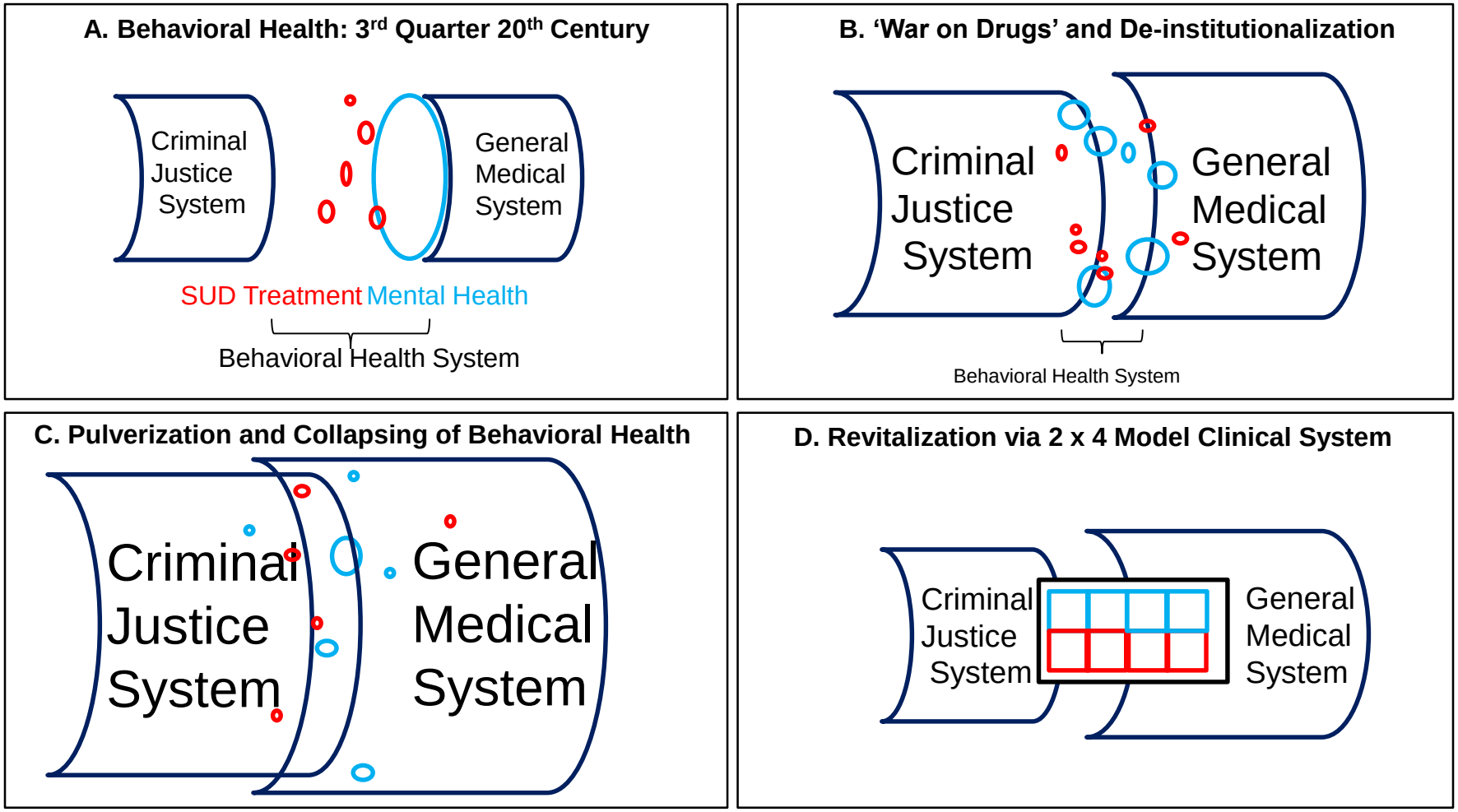


Figure 12. **A.** By 1975 , behavioral health was still composed of a relatively strong infrastructure and professional workforce although addictionology and mental health were largely un-integrated. **B.** With progression of the *war on drugs* and *de-institutionalization*, more mentally ill/addicted people became criminalized and behavioral health became more fragmented, loosing 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.

Figure 13

The 2 x 4 Model: Horizontal Binding

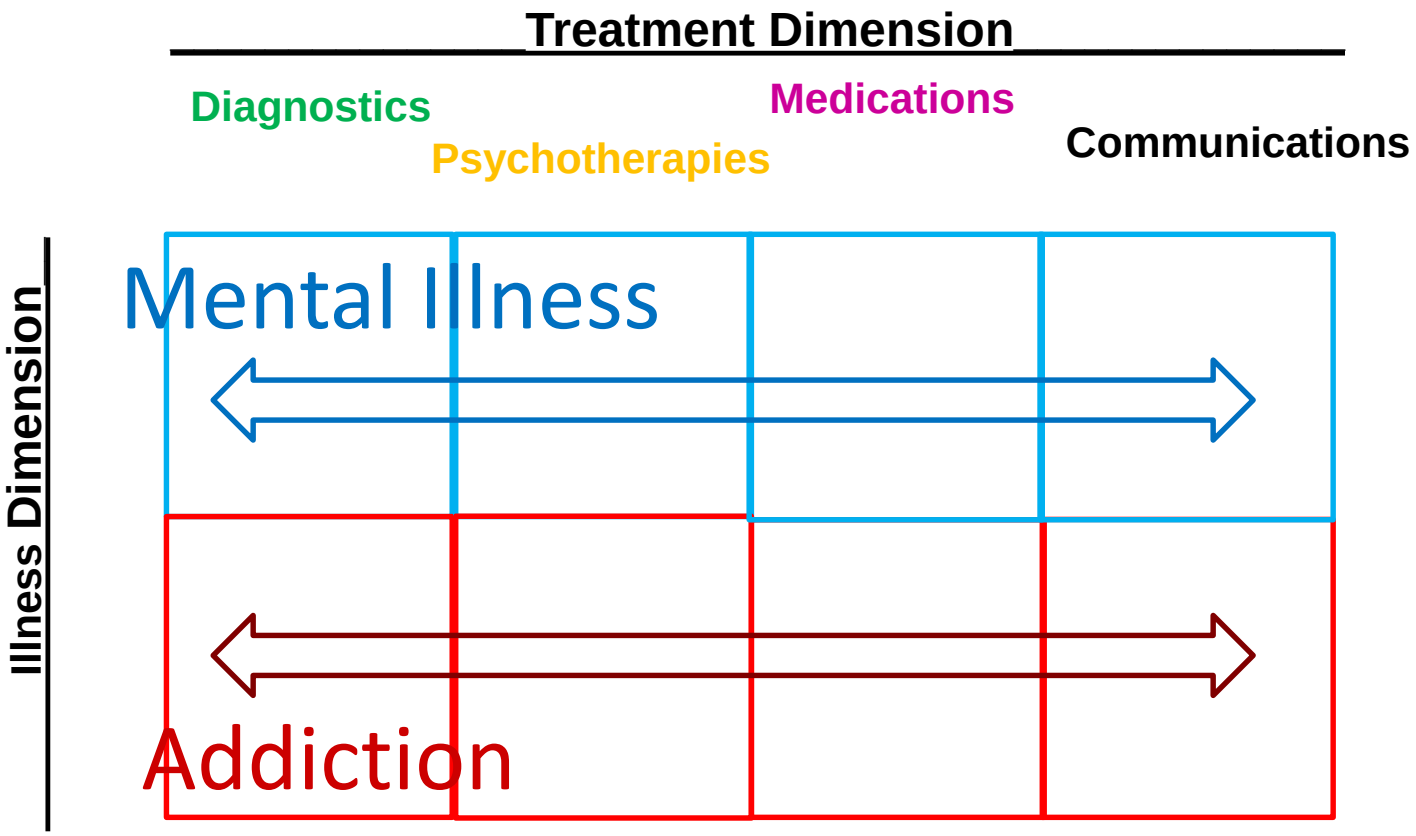


Figure 14

The 2 x 4 Model: 2 Dimensional Binding

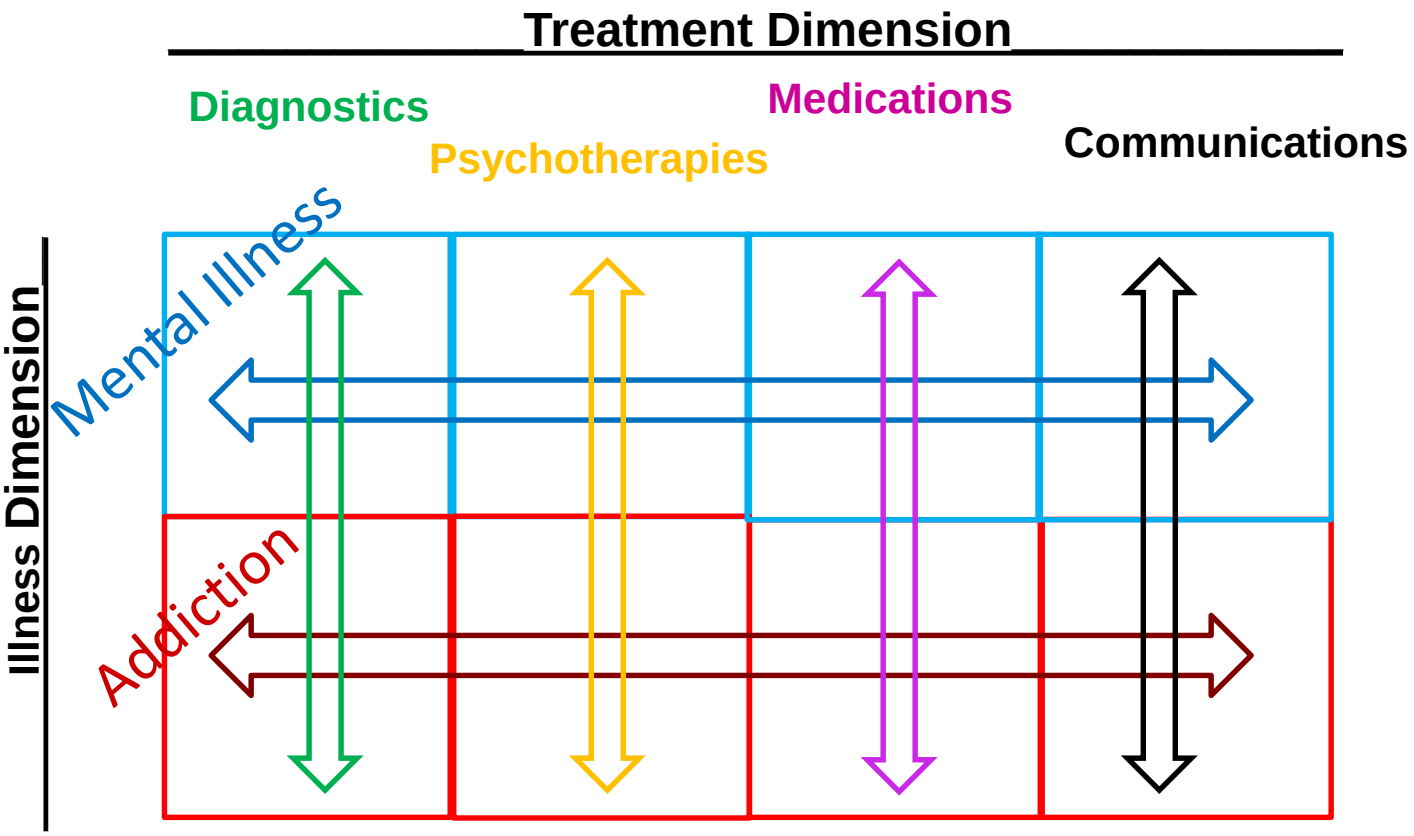


Figure 15

Points of Attack in 2 x 4 Model Treatment

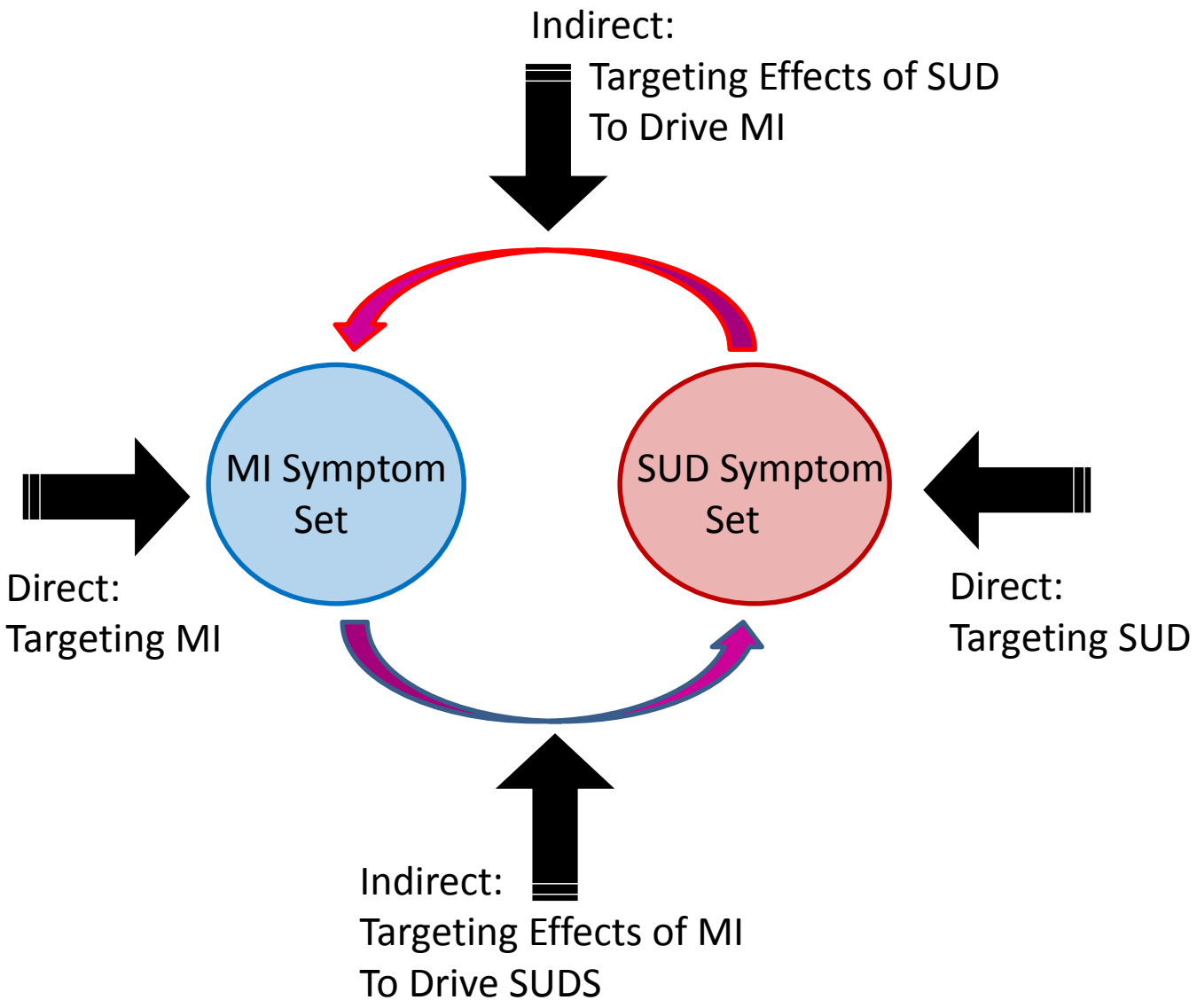
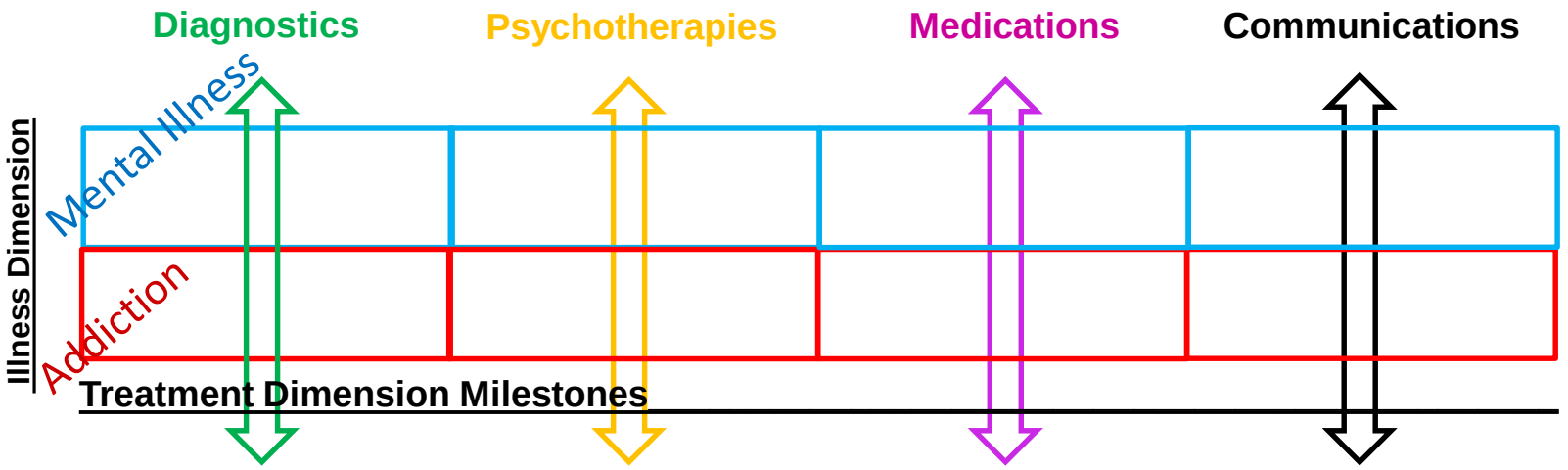


Figure 16

The 2 x 4 Model & Addiction Psychiatry ACGME Milestones



PC1. Evaluation and Diagnosis (**Chapters 3, 5**)

PC2/MK3. Psychotherapy, behavioral, psychosocial Interventions (practical/technical knowledge) **(Chapters 3,6)**

PC3. Pharmacological Interventions **(Chapters 3, 7)**

SBP3/SBP4. Community Based Care/ Consultation to general psychiatrists, non-psychiatric providers, non-medical systems **(Chapters 3,8)**

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**)

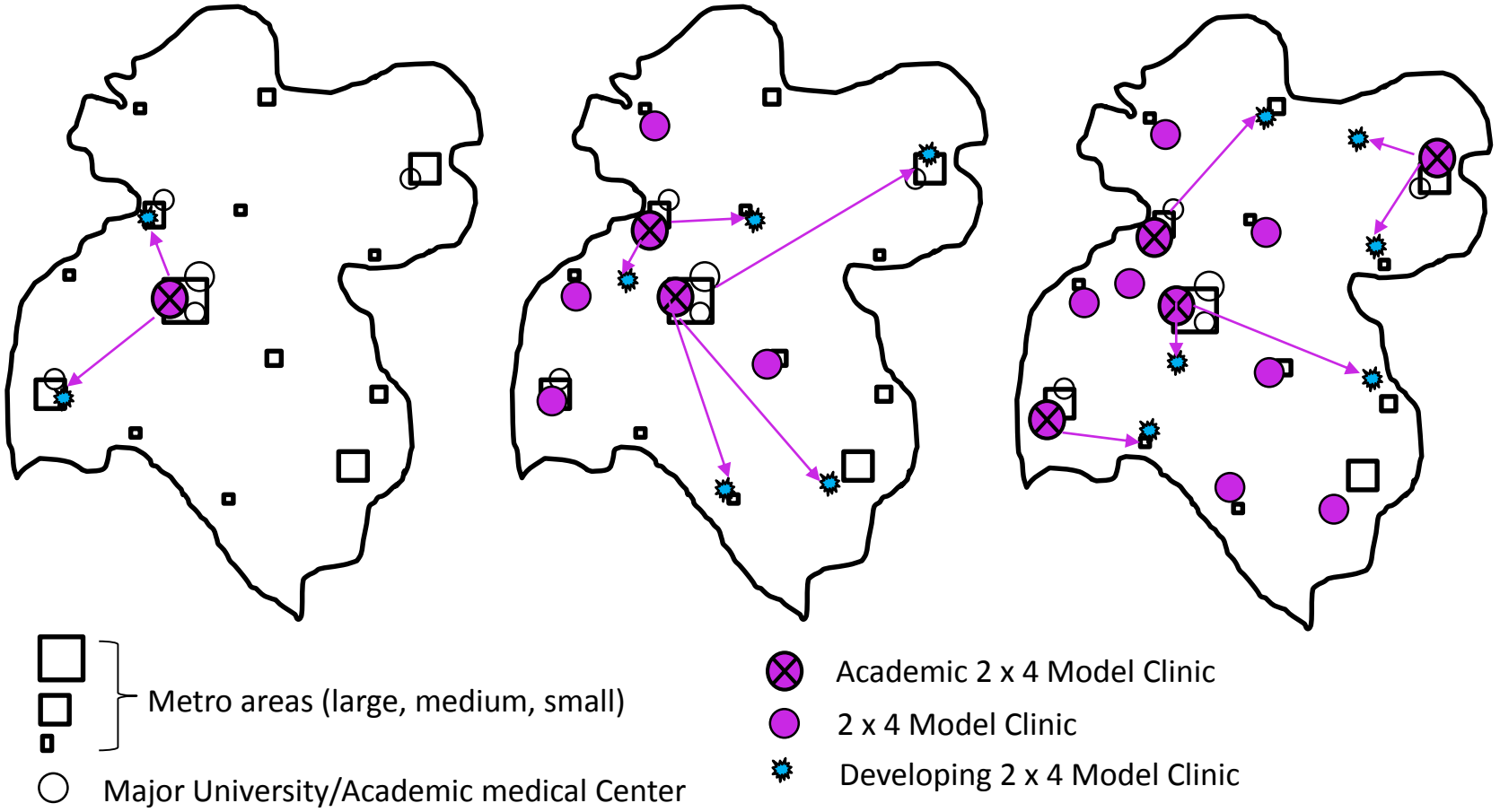


Figure 17. Guided replication and geographical spread of a system of 2 x 4 Model Clinics across a region or state over several years. Academic 2 x 4 Model Clinics founded in University towns could provide training, staffing support and fidelity monitoring to Developing 2 x 4 Model Clinics in proximity. 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.