Exercise, the Road to Recovery

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Maryland /National Statistics

• Death from heroin and other synthetic opioids now the leading cause of death in US, in ages 50 or younger. 64,000/yr.

• 8-12% of population experience a substance abuse disorder. Aprox. 1/3 drugs, 2/3 alcohol.

• Maryland ranked 5\textsuperscript{th} in nation in regards to Drug Use and Addiction
Figure 5. Total Number of Drug- and Alcohol-Related Intoxication Deaths by Selected Substances\(^1\), Maryland, 2007-2017.

\(1\)Since an intoxication death may involve more than one substance, counts of deaths related to specific substances do not sum to the total number of deaths.

\(2\)Includes deaths caused by benzodiazepines and related drugs with similar relative effects.
Figure 5. Number of Carfentanil-Related Deaths Occurring in Maryland from January through September of Each Year.*

*2017 counts are preliminary.
**Screening for Carfentanil began in 2016, first detected in 2017
Medical Aspects

Estimate of long and short term effects of substance abuse on health care

- Either the primary or secondary cause of care
- 20% of patients in out patient setting
- 20-50% of Hospitalized Patient
Substance Abuse Disorder

Definition: A chronic relapsing brain disease characterized by an impaired ability to stop or control substance abuse, despite adverse social, occupational or health consequences.
Epidemiology- SUD

• 1. Alcohol and drug abuse: may affect 12-20% of population.
• 2. Cost: $500,000,000/yr?
• 3. Spontaneous remission very low!!
• 4. Relapse Rates: 60-90% in 1st yr.
• 6. Long term sobriety (recovery) 10 to 90%
GOAL

How exercise effects the brain and can be an adjunctive treatment for chemical dependence.

Recommendations for how much exercise to perform and general health benefits to be gained.
RECOVERY

PHYSICAL

MENTAL

SPIRITUAL
GENERAL POPULATION ATTAINING HEALTHY ACTIVITY LEVELS

Only 15-30% of Americans perform minimal exercise requirements, and less than 10% of moderate to vigorous activity levels.
## Benefits of Regular Physical Activity and/or Exercise

<table>
<thead>
<tr>
<th>Cardiovascular *</th>
<th>Cardiovascular *</th>
<th>Mortality *</th>
<th>Other *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>Risk Factors</td>
<td>Morbidity</td>
<td></td>
</tr>
<tr>
<td>Increased MVO2</td>
<td>Reduced BP</td>
<td>All Cause</td>
<td>Reduced Anxiety</td>
</tr>
<tr>
<td>Improved Minute</td>
<td>Syst/Dias</td>
<td>Cardiac</td>
<td>Depression</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Reduced Body</td>
<td>Secondary</td>
<td>Improved</td>
</tr>
<tr>
<td>Reduced HR, BP</td>
<td>Fat/Lipids</td>
<td>Prevention</td>
<td>Cognitive Function</td>
</tr>
<tr>
<td>during exercise</td>
<td>Glucose Metabolism</td>
<td></td>
<td>Dependent</td>
</tr>
<tr>
<td>Lactate Threshold</td>
<td>Reduced Inflammation</td>
<td></td>
<td>Living/Falls/ADL</td>
</tr>
<tr>
<td>Exercise Capacity</td>
<td></td>
<td></td>
<td>Addiction</td>
</tr>
</tbody>
</table>

*All are evidenced based

ACSM’s, Guidelines for Exercise Testing and Prescription-10th Edition
EXERCISE RECOMMENDATIONS

1. 30 minutes daily at least 5X a week at moderate level (60-70% PMHR).
2. 75 minutes a week at vigorous level (70-80%).
300 min. of moderate + 150 min. vigorous for extensive health benefits.
3. Perform stretching daily, strength training 2X weekly.
4. 10 min. warm up, at least 5 min cool down
5. Can provide a 50% reduction in all cause mortality and at least a 30% in CV disease
TREATMENT MODALITIES for SUD

1. Rehabilitation 30-90 days?
2. 12 Step Programs, Faith based participation and other support groups
3. Counseling
4. Cognitive Behavior Therapy
5. Medical (drug therapy)
6. Exercise
7. Meditation/Yoga
8. Psychiatric or Psychological care for co-morbid conditions
9. Experiential Therapy, ie. Art, Equine, Gardening etc.
POSITIVE ADDICTION

The author of REALITY THERAPY and TAKE EFFECTIVE CONTROL OF YOUR LIFE tells you how to gain strength and self-esteem through positive behavior.
Medical Therapy for SUD

*Long Acting Opioid Agonist:
  Methadone
  Buprenorphine, Suboxone (Buprenorphine + Naloxone)
*Risk of addiction, drug interactions, Diabetes, nicotine addiction and premature death, opioid overdose.

**Opioid Antagonist:
  Naltrexone: blocks endorphins
  Naloxone: receptor antagonist, for opioid overdose, IV, IM, or IN

**Risk of opioid withdrawal
Benefits of Exercise in Recovering Individuals

• 1. Increased self efficacy for abstinence.
• 2. Improved mood states, reduced depression.
• 3. Decreased urges and craving.
• 4. Improved coping strategy/skills
• 5. Provides a natural pleasure state.
• 6. Positive alternative to substance abuse.
• 7. Decrease stress activity
• 8. Health Benefit
• 9. Cost/ benefit ratio astronomical.
IMPACT of PHYSICAL EXERCISE on SUBSTANCE ABUSE DISORDERS: A META-ANALYSIS

22 Studies: alcohol, illicit drugs and cigarette smoking.
• 1. Increased abstinence
• 2. Ease withdrawal symptoms
• 3. Reduce anxiety and depression
• Moderate and high intensity aerobic exercise performed by Guidelines of ASCM and Mind-Body exercise can be effective and long term treatment for those with SUD.

• Oct. 2014 Wang et. Al.
Figure 4. Neural Reward Circuits Important in the Reinforcing Effects of Drugs of Abuse.

As shown in the rat brain, mesocorticolimbic dopamine (DA) systems originating in the ventral tegmental area include projections from cell bodies of the ventral tegmental area to the nucleus accumbens, amygdala, and prefrontal cortex; glutamatergic (GLU) projections from the prefrontal cortex to the nucleus accumbens and the ventral tegmental area; and projections from the γ-aminobutyric acid (GABA) neurons of the nucleus accumbens to the prefrontal cortex. Opioid interneurons modulate the GABA-inhibitory action on the ventral tegmental area and influence the firing of norepinephrine (NE) neurons in the locus ceruleus. Serotonergic (5-HT) projections from the raphe nucleus extend to the ventral tegmental area and the nucleus accumbens. The figure shows the proposed sites of action of the various drugs of abuse in these circuits.
The brain of an addict

Cocaine use causes a decrease in glucose metabolism in the brain, especially in the frontal lobes, where planning, abstract thinking and regulation of impulse behavior are governed.

Glucose metabolism

Lower activity  Higher activity

Frontal lobes

Normal subject

Cocaine abuser 10 days after abuse stops

Cocaine abuser 100 days after abuse stops
Rat Race

Three groups:
1. Drank alcohol, no exercise: had loss of neurons
2. Drank alcohol and exercised.*
3. Drank H2O and exercised.*

*Groups 2+3 had increased neurogenesis

Alc 33 (2004) 63-71
EXERCISE EFFECTS on the BRAIN

• 1. Neurogenesis, increased BDNF.
• 2. Mood enhancement, Serotonin?
• 3. Endorphin release.
• 4. Dopaminergic reinforcement
• 5. Increased Norepinephrine
• 5. Increased Glutamate, and GABA.
• 6 Phenylethylamine
• 7 Increased brain plasticity
BRAIN DERIVED NEUROTROPHIC FACTOR

1. Promotes neurogenesis esp. in Hippocampus (Center of learning and Memory)
2. Protects existing neurons.
3. Promotes synaptic plasticity: increases efficiency of signal transmission across synaptic cleft between neurons
*Brain starts to lose nerve tissue at 30 yoa
4. Increase in gray matter volume
5. Decrease in cognitive decline and dementia
Exercise Induced Euphoria or Why Some Patients Love to Exercise

• After 30 minutes of continuous exercise at least 70% PMHR several neurohumors are released.
• Dopamine: Euphoria, heightened awareness
• Endorphins: powerful pain relief, but has limited crossing of the blood-brain barrier, euphoric.
• Seritonin: markedly improves mood.
• Anandamide: an endocannaboid which markedly improves mood and reduces pain sensation. (THC-Marihuana)
• Phenylethylamine: potent catacholamine, like Methamphetamine, but shorter acting and exhibits no tolerance. Can be found in urine 24 hr. post exercise, 77% above baseline. Found in Chocolate!
ENDORPHINS

• 1. Like heroin and morphine, but is a natural substance. (neuropeptide)
• 2. Blocks physical and mental pain.
• 3. Released after 30 minutes of sustained aerobic exercise.
• 4. Produces Euphoria
Serotonin
Neurotransmitter

• 1. Found throughout the brain.
• 2. Perception, mood control, temperature regulation
• 3. Tryptophan a precursor, increased during and after exercise.
• 4. Low in depressive states
Norepinepherine
Neurotransmitter + Hormone

1. Regulates arousal to environment.
2. Mood enhancement and dreaming
3. Hormonal Effects:
   Blood Pressure
   Vaso-constriction
   Heart rate
Dopamine
Neurotransmitter

1. Reward motivated behavior.
2. Stimulants to receptors (NA) highly addictive.
3. Exercise increased in VTA but not NA
GABA-Glutamate
Neurotransmitters

1. GABA: anxiety reducing, prevents over-excitation in glutamate receptors. (Benzodiazepines action site)
2. Glutamate: primary excitatory neurotransmitter in brain. (Alcohol action site)
3. Both found throughout the brain
4. *Greater neurogenesis in GABA neurons in chronic exercise.
   *Animal studies, but seen as calming effect clinically in humans.
Phenylethylamine
Neurotransmitter

• 1. Precursor of Catacholamines
• 2. Releases: Norepinepherine and Dopamine
• 3. Amphetamine derivative
• 4. Anti-depressant Effects
• 5. Runner’s High? Individual response variable
• 6. Chocolate: contains phenylethylamine
• 7. Boosts mood as quickly as Methamphetamine without side effects or intolerance
• 8. Low levels of phenylacetic acid in urine of children with ADHD
Percentage difference in urinary phenylacetic acid after exercise.


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PATIENTS EARLY in RECOVERY

• Patients in substance abuse treatment exhibit low rates of physical activity, yet have a high interest in beginning an exercise program in early recovery.

• Would seem to be a good time to be pro-active and establish goals in relation to their health and exercise goals!
EXERCISE EFFECTS on PHASES of SUBSTANCE ABUSE

• 1. Decrease in initiation of use.
• 2. Decrease progression from use to addiction.
• 3. Decrease symptoms of withdrawal.
• 4. Decrease relapse to drug use.
• 5. Increase maintenance of sobriety
<table>
<thead>
<tr>
<th>EXERCISE PROGRAM TYPE</th>
<th>PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do-it yourself with professional guidance.</td>
<td>47%</td>
</tr>
<tr>
<td>2. Do-it yourself.</td>
<td>42%</td>
</tr>
<tr>
<td>3. Rely on professional supervision.</td>
<td>18%</td>
</tr>
</tbody>
</table>

51% prefer to exercise alone.
Preferred Type of Exercise

1. Walking 75%, (women)
2. Resistance training 37%, (men)
3. Gym/YMCA 33%
4. Sports 32%
5. Swimming 28%, (women)
6. Exercise videos 25%, (women)
7. Yoga/Stretching 22%, (women)
8. Running 18%, (men)
BARRIERS to COMPLIANCE

1. Time constraints
2. Cost
3. Physical impairments
4. Emotional motivation!!!!
5. Availability
6. Environment
Exercise Addiction

• 1. Exercise has a low incidence of Addiction.
• 2. Runner’s High: low occurrence
• 3. Dopamine release from VTA vs. NA, less addicting than any of those identified in SUD.
• 4. Continue to Exercise: despite personal injury, inconvenience, disruption to other areas of life, ie. Marital, occupational et al.
• 5. Exercise for intrinsic rewards.
• 6. Experience disturbing deprivation sensations when unable to exercise.
• 7. Phenylethylamine?
Healthy Committed Exercise

• 1. Exercise at recommended levels (ACSM)
• 2. Exercise for extrinsic rewards.
• 3. Experience a sense of well-being, accomplishment, and health.
• 4. Do Not suffer from withdrawal symptoms
• 5. Have “Drive to Exercise but are not Driven
Healthy Physical Activity/Exercise

• 1. The goal should be to acquire a sense of balance and structure.
• 2. Develop an attitude resulting in a sustainable long term psychological, social and health outcomes.
• 3. Is a non-pharmacologic treatment for SUD, that targets both early and late phases of the addiction process.
• 4. Results in secondary health benefits.
• 5. Should be recommended to all appropriate individuals with a SUD, as adjunct therapy for recovery.
• 6. Exercise recommendations should follow the guidelines of ACSM