Incentives in the Treatment of Substance Use Disorders and Beyond

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Objectives

- Overview of the behavioral model of substance abuse
- Behavioral principles underlying incentive-based interventions: Contingency Management (CM)
- Rationale for why this approach for substance abuse
- Overview of evidence for different types and applications of CM for substance use and related problems; focus on some of our research on Cannabis Use Disorder interventions
- Future directions and extension to other Health Behavior problems

Behavioral Model of Drug Abuse

- Behavior Analysis and Behavioral Pharmacology
  - Drugs of abuse are potent reinforcers
  - Drug use is considered operant behavior
  - Drug use is normal, "learned" behavior; all susceptible
  - Genetic and acquired characteristics that affect probability of abuse/dependence are givens
  - Environmental contexts and contingencies of reinforcement determine abuse development

Behavioral Factors

- Drug taking maintained by "immediate" positive consequences that are consistent
  - Feels good
  - Social Rf / Peer acceptance
  - Short term improvement in mood
  - "Relief" from adverse states (mood, thoughts, anxiety, withdrawal, etc)

*** Drugs have multiple positive effects

Behavioral Factors

Sub-populations with greatest rates of substance use problems

- Most psychiatric disorders (anxiety, depression, SMI)
- Impoverished / Disadvantaged Populations

Does not mean these individuals are "self-medicating"; however, the reinforcing efficacy of substances may be greater and the potential negative consequences not as compelling

Behavioral Factors (2)

- Negative consequences of use are "distant" and not consistent
  - Employment or academic failure
  - Medical problems
  - Legal problems
  - Relationship / family problems
  - Psychiatric problems

Substance Abuse Problems

- Game of Probabilities
- Individual Vulnerabilities
  - Biologic, inherent
  - Environmental, Social
  - Historical
- Substance abuse problems: Reinforcement associated with taking the Substances has won out over more prosocial sources of reinforcement

Behavioral Change becomes Hard!

- Once Drug Abuse becomes well established (well learned); it is difficult to change
- But, it is "learned behavior" and therefore amenable to change via same processes as other types of behavior

Goals for Behavioral Treatment

Behavior Change

1) Decrease/eliminate drug use and drug-using behavior

2) Increase incompatible, non-drug related, behavior that can replace or compete with drug use

- Avoid contexts that set the occasion for use
- Find alternative sources of reinforcement

AA slogans:

- change people, places, things
- HALT: don't get Hungry, Angry, Lonely, Tired

Contingency Management

- Based upon a simple operant principle
  - if a behavior is reinforced or rewarded, it is more likely to occur in the future
- This principle occurs naturally in our environments, and is purposely used in everyday life; it occurs whether you control it or not.
- In the case of substance abuse treatment, drug abstinence, as well as other behaviors consistent with a drug-free lifestyle, can be reinforced using these principles.

General Principles of CM

- CM arranges for delivery of systematic consequences for drug use, abstinence, or other therapeutic goals (e.g., counseling attendance, medication compliance).

- Reinforcement and punishment contingencies are effective, but reinforcement is preferred by clients and clinicians (and has fewer unexpected consequences)

CM Treatment Model

- Select Target Behavior or Goal
  - drug abstinence, clinic attendance, homework
  - high probability of success
  - must be able to objectively verify
- Method to detect/monitor the Target Behavior
  - urinalysis testing (frequency)
  - objective verification of therapeutic behaviors
  - self-report is not sufficient

CM Treatment Model (2)

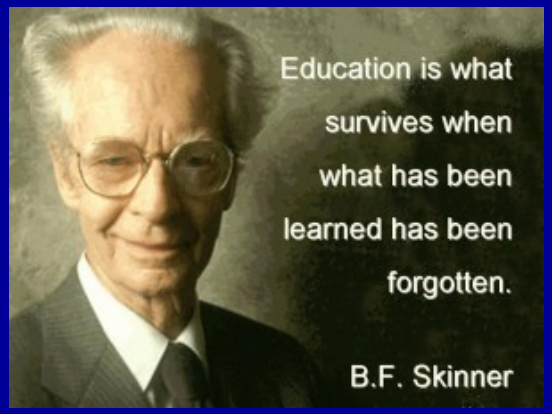
- **Choose Incentives (Consequence)**
  - Select as potent consequence as is feasible (magnitude)
  - monetary, vouchers, methadone increases, access to housing or work opportunities, disability check access
- **Initiation / Duration**
  - Should match up with your rationale for using CM
    - Initiate abstinence, maintain abstinence, improve engagement, increase regular attendance, continuous abstinence
- **Consequence Delivery**
  - Schedule: Frequency, fixed, random, intermittent, delay

CM/Behavioral Treatment Model (3)

- Concomitant Goal: Increase Non-drug Reinforcement
  (e.g., relationship satisfaction, hobbies, employment)
  - use consequences or behavioral counseling

- CM is typically combined with other forms of behavioral or pharmacological treatment

History of the CM (Behavior Analysis)



The Dark Side of principles of reinforcement: people eat foods that are ultimately bad for them, drink too much, smoke tobacco, and use illicit drugs because the immediate positive feelings are so powerful.

CM takes charge of the principles of reinforcement to use if for Good, by arranging the environment so reinforcing consequences eliminate harmful behavior and shape up prosocial behavior.

History of the CM (Behavior Analysis)

Token Economies....cigarettes on the psychiatric wards to reinforce appropriate behavior!

Early studies clinical studies with alcoholics

Use of take-home medication in the methadone clinic to reduce opiate and other substance use

Clinical analog studies using financial incentives to reduce benzodiazepine use in methadone patients, cigaretter smoking, etc ....Leibson, Stitzer

Higgins cocaine studies ushered in the Modern Era of use of CM / Incentives to Enhance Outcomes for Substance Abuse Treatment...(early 1990's)

CM Efficacy Trials

Substances

- Cocaine
- Opiates
- Tobacco/Nicotine
- Marijuana
- Methamphetamine
- Alcohol
- Polysubstance
- Benzodiazepines

Related Targets /Consequences Used

- Medication Adherence
- Treatment Attendance
- Prosocial Activities or Treatment Goals
- Work Attendance and Performance
- Access to Housing
- Access to Disability Checks
- Risky sexual behavior

Reviews of the CM Literature

Stitzer & Petry (2006)
Stitzer & Vandrey (2008)
Plebani et al., (2006)
Higgins et al., (2002)
Higgins & Silverman (1999)
Higgins & Petry (1999)

Forronato et al. (2013) CM vs. CBT Cocaine Dependence (Switzerland)
Schierenberg A et al (2012) CM for Cocaine Dependence (Netherlands)
Stanger & Budney (2010) Adolescents
Ledgerwood (2008) Tobacco smoking

Also reviewed in general Substance Abuse Treatment Literature

Voucher-based CM Increases Cocaine Abstinence among Cocaine-Dependent Outpatients and among Heroin-Dependent Cocaine Abusers

- Series of randomized clinical trials

Higgins et al., 1991, 1993, 2001; 2003; 2004; 2007....
Silverman et al., 1996; 1998; 2001; 2003...

Voucher Incentive Programs

Voucher-based reinforcement therapy (VBRT)
Abstinence-based reinforcement therapy (ABRT)
Abstinence-based voucher therapy (ABVT)
Abstinence-based incentives

Provide monetary-based (financial) incentives contingent on drug abstinence documented via urinalysis testing (bank account analogy)

Original Voucher Program for Cocaine Dependence

- Weeks 1-12 earn points for each cocaine-negative urine specimen / self-report of no use (tested 3x/week)
- Points have a monetary value
- Value increases with each consecutive cocaine sample
- $10 bonus for each cocaine-negative week
- Cocaine-positive specimens results in a reset of value to the initial value
- Maximum earnings across treatment was $1090

(Higgins et al. 1991)

Voucher Program

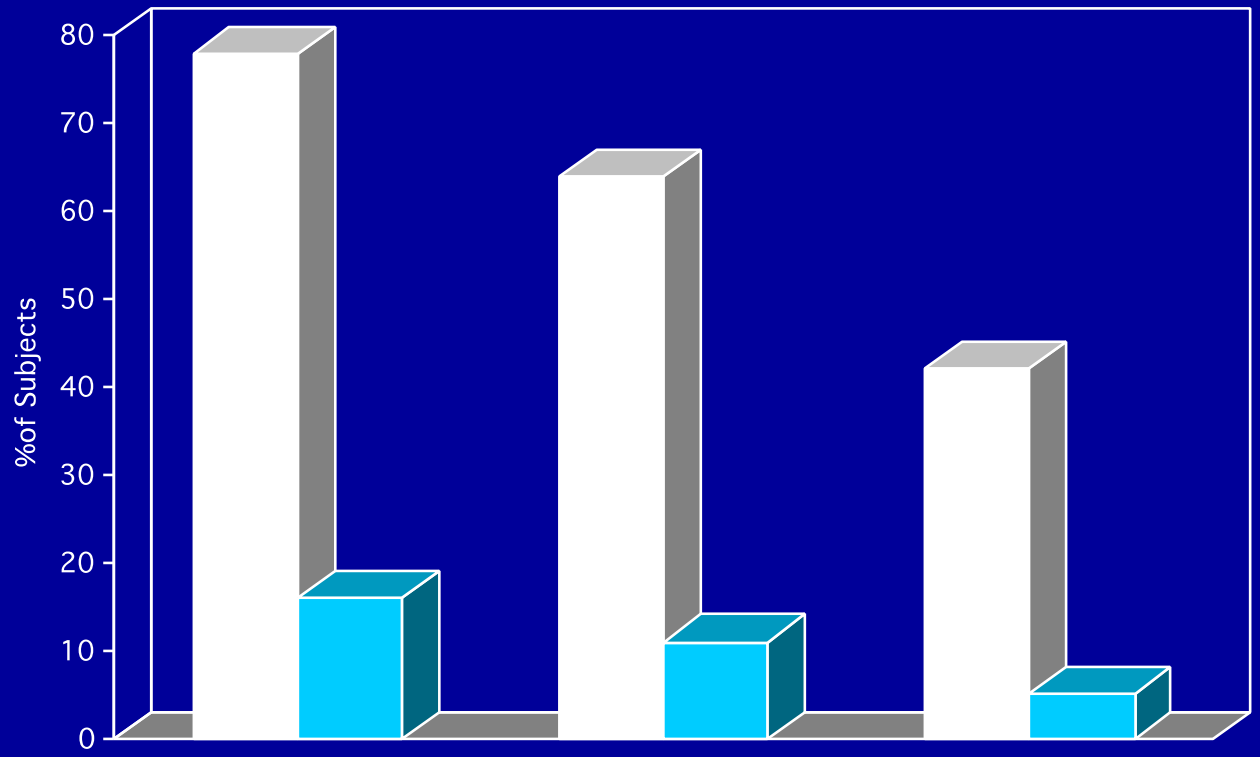
No cash provided

Can spend vouchers on approved items any time after they are earned

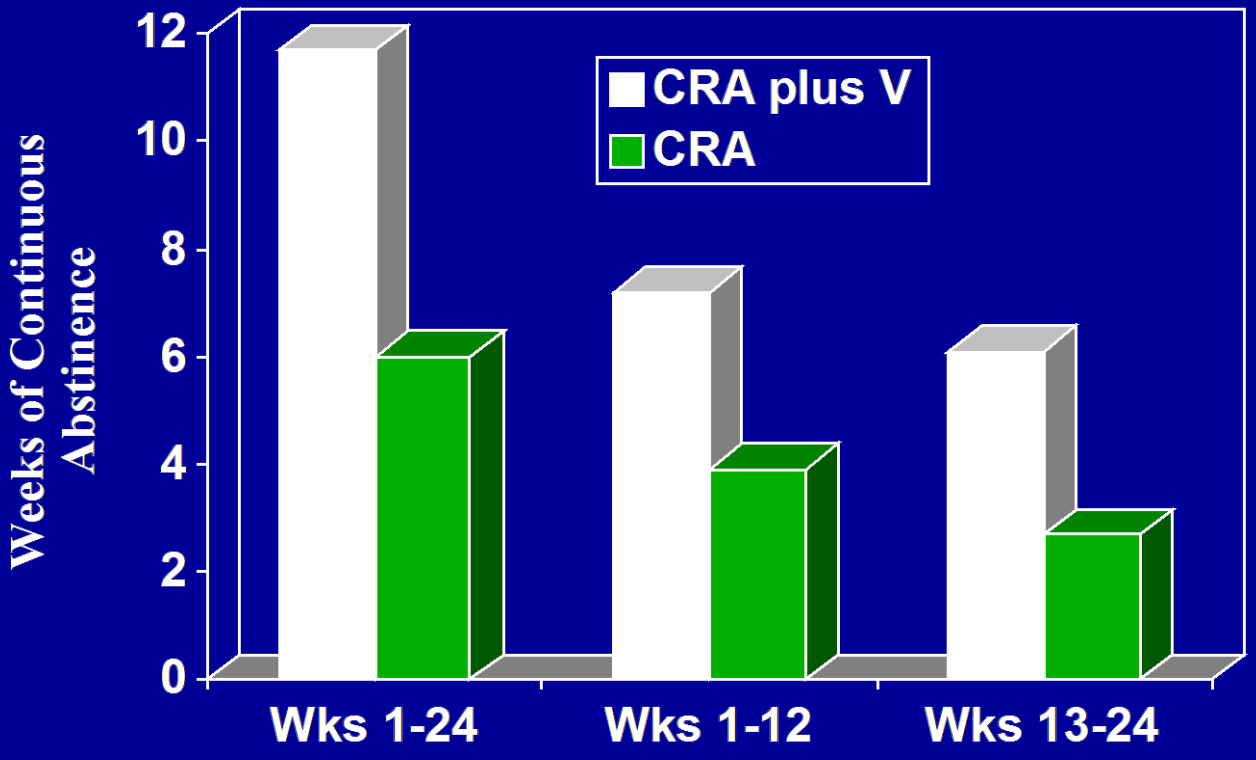
Staff make available the retail items or services (gift cards, restaurant gift certificates, sport equipment, movie passes, work clothes, etc.)

Integrated with CRA to facilitate lifestyle change and increased reinforcement from prosocial activities

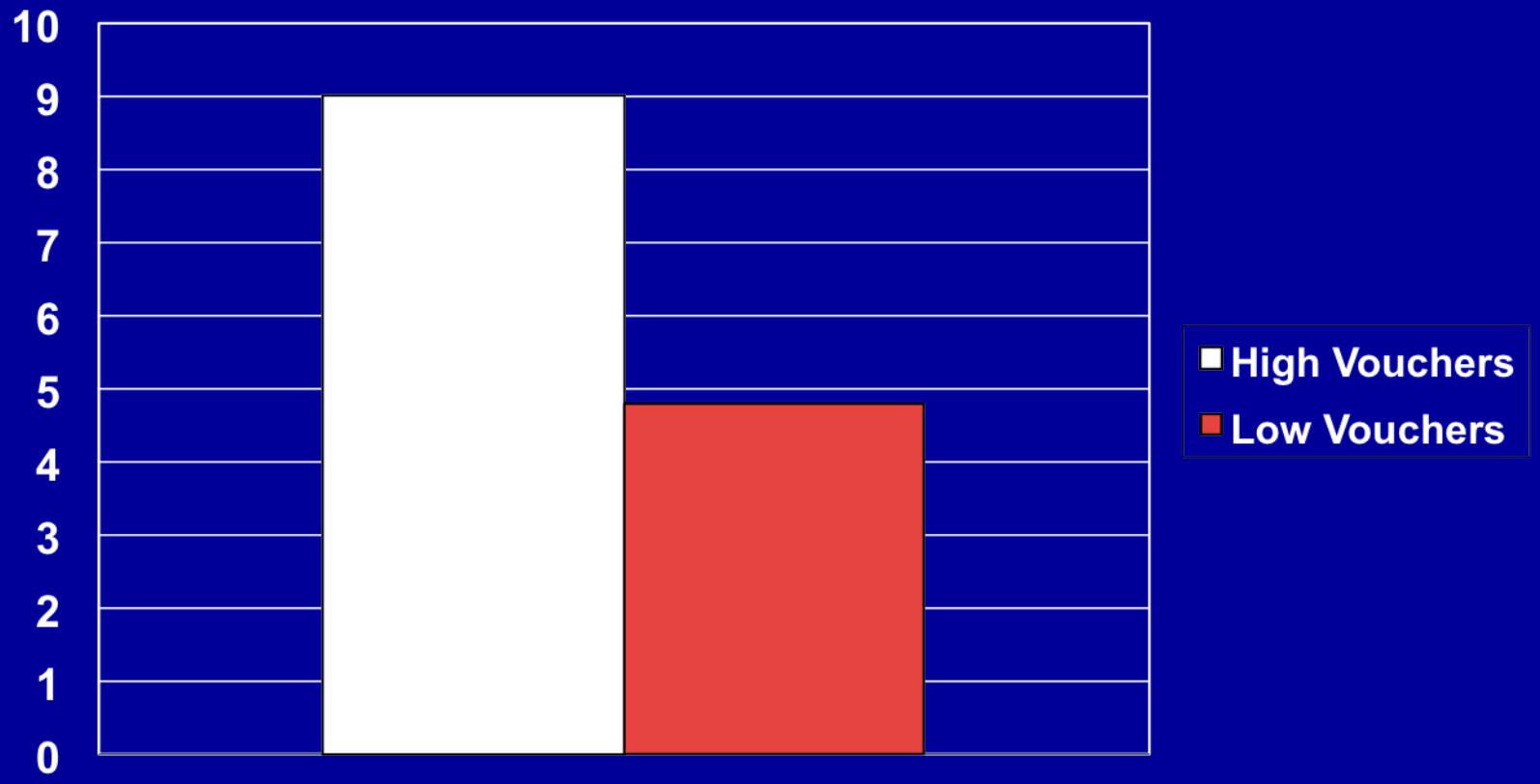
Cocaine Dependence
CRA plus Vouchers vs Standard Care
(Higgins et al. 1993)



Cocaine Dependence
CRA plus voucher vs CRA alone
(Higgins et al., 1994)



Cocaine Dependence Magnitude Matters



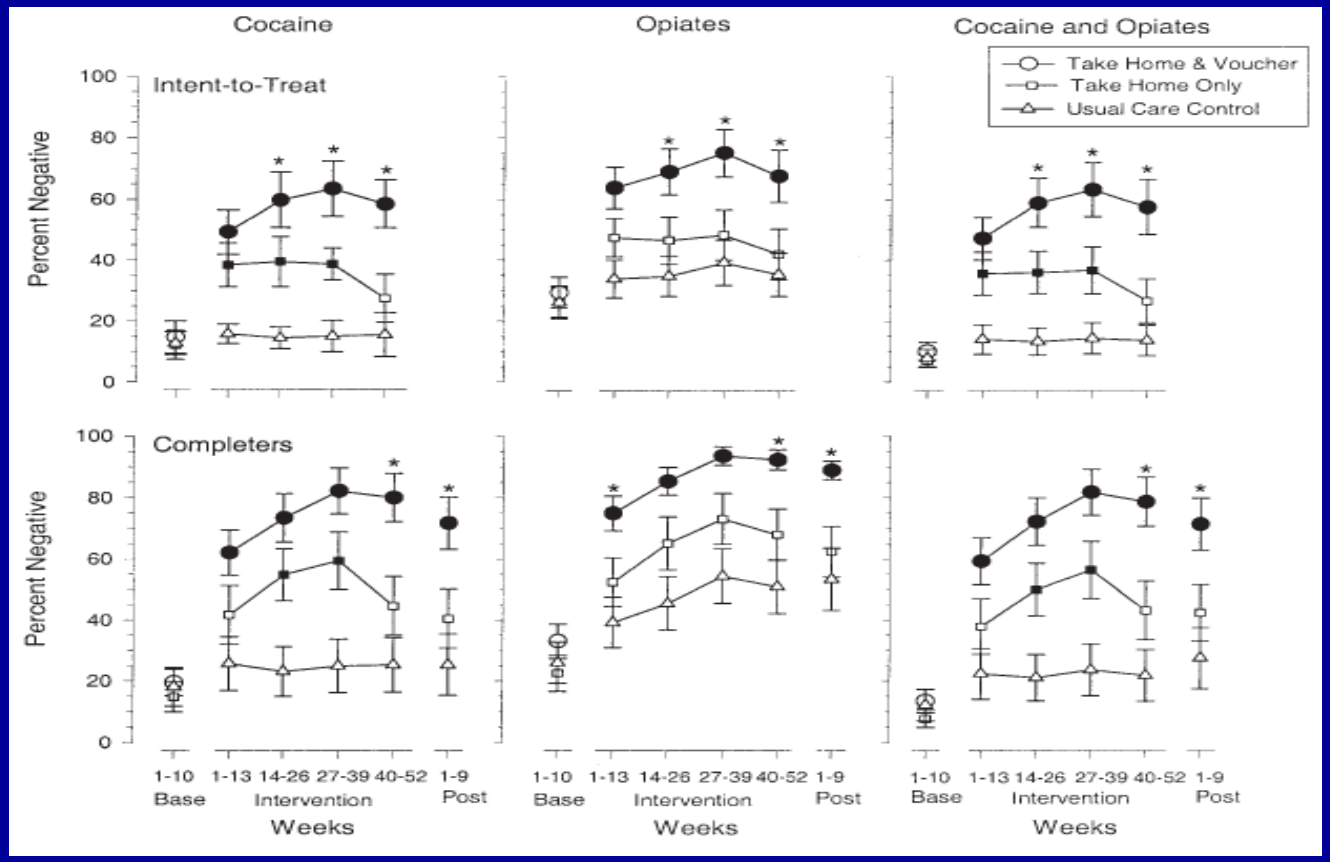
Higgins et al., 2007

Vouchers for Cocaine Abuse In Methadone-Maintained Population

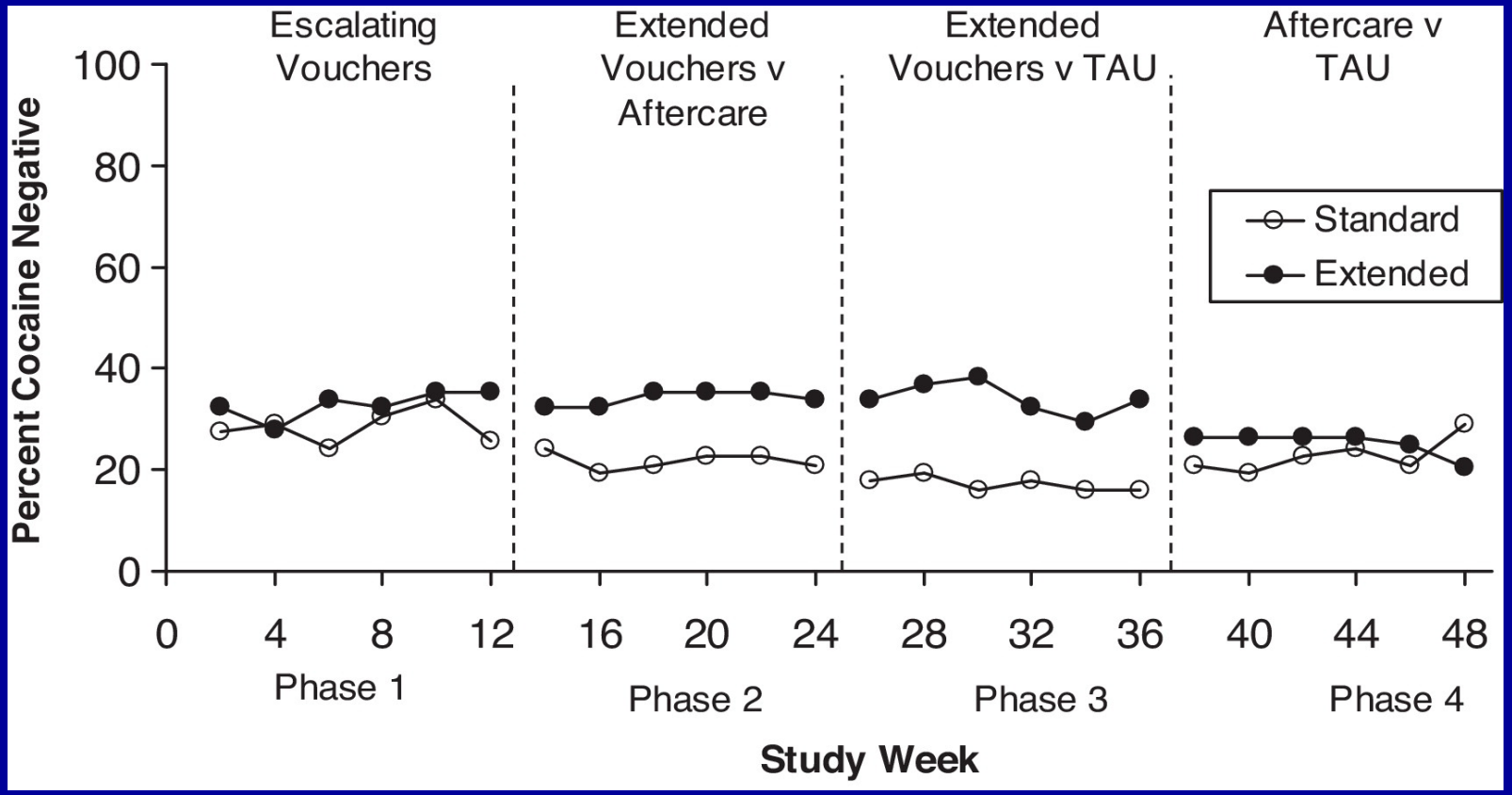
(Inner City Baltimore)

(Silverman et al., 1996, 1998, 2001, 2004.....)

Vouchers plus Take-homes for Cocaine Abuse For Sustained Abstinence (Silverman et al., 2004)



Randomized trial examining duration of voucher-based reinforcement therapy for cocaine abstinence (Kirby et al., 2013)

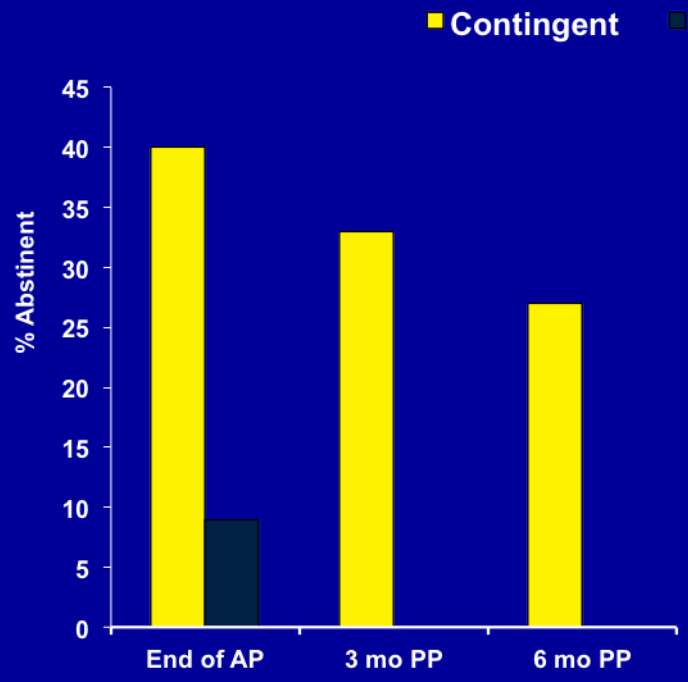


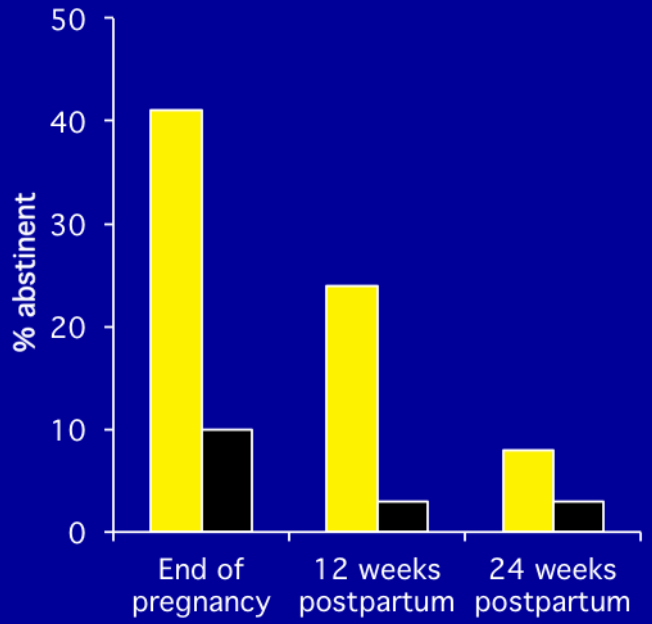
Cigarette Smoking During Pregnancy
Abstinence-based Incentives to promote smoking cessation among disadvantaged women

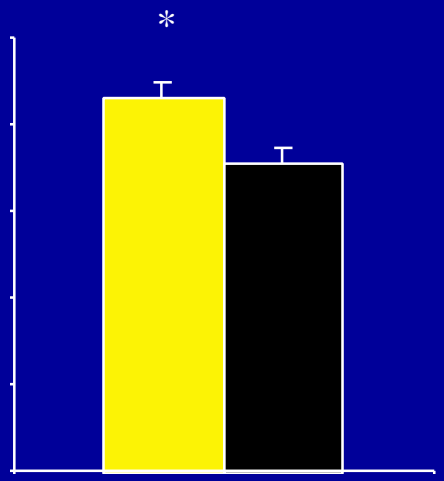
Higgins et al., series of studies

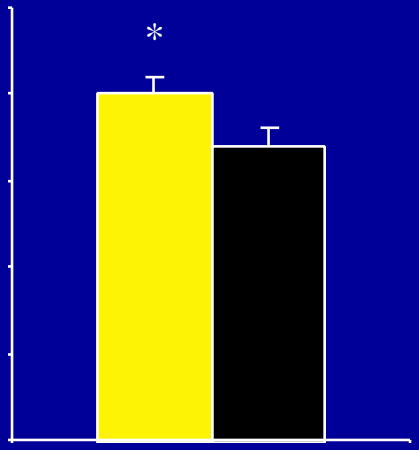
Abstinence Rates (S-R + biochemical verification)

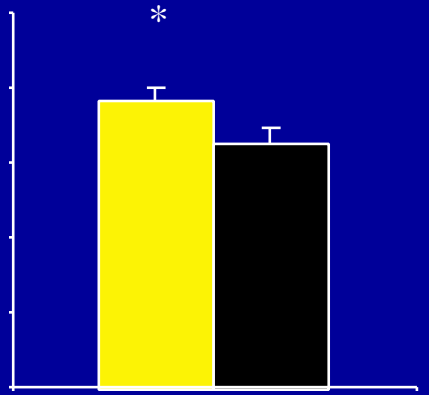
(Higgins et al., 2004; Heil et al, 2008)











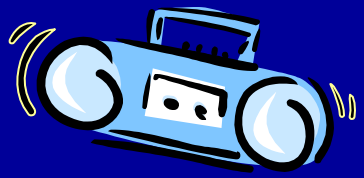
The Fishbowl
Prize-based Reinforcement
(Petry et al. 2000)

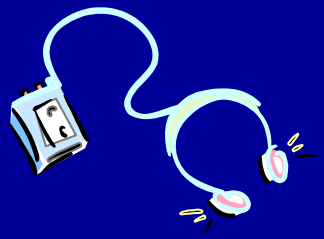
- Earn pulls from a "fishbowl" for meeting target goal (abstinence, completion of therapeutic activities, etc.)

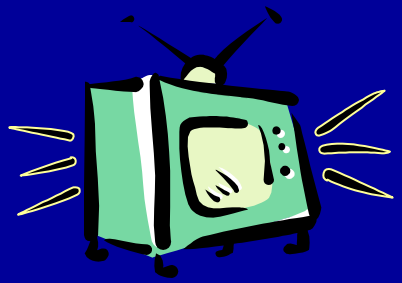
- Intermittent Reinforcement schedule:
  - each pull has a "probability" of earning a prize

Half the pulls are winning

- 1/2 chance of winning a small $1-2 prize
- 1/16 chance of winning a medium $20-25 prize
- 1/250 chance of winning a jumbo $100 prize







Prize-based CM Efficacy Trials

Alcohol Dependence
Cocaine Dependence – Magnitude Study
Methamphetamine Dependence (also in SMI population)
Therapy Attendance
Therapeutic, prosocial activities

Reinforcement-based Workplace

Pregnant/postpartum; Injection drug users,; homeless alcoholics, welfare recipients

Silverman et al., DeFulio et al.(2001; 2004; 2006; 2007, 2009, 2011)

Target Treatment Plan Activities (Vouchers)

Treatment Plan Activities vs. Abstinence

Iguchi et al. (1997)

Target Participation with Juvenile Offenders (Vouchers)

Sinha et al 2005; Carroll et al., 2007

Target Housing for Homeless Substance Abusers (Vouchers)

Abstinent Contingent Housing > Usual care

Milby et al. (1997, 1999)

Target Aftercare Attendance

(Non-monetary, Social Reinforcement)

Lash et al. (2004; 2005; 2007)

CM to increase Group Therapy Attendance

(Ledgerwood et al., 2008)

Vouchers for Naltrexone Ingestion in Recently Detoxed Opiate-Dependent Patients

Preston et al., 1997

CM for Managing Disability Benefits with Severe, Chronic Mental Illness and Substance Dependence

Ries et al., 2004

Randomized Controlled Trial of Contingency Management for Stimulant Use in CMH Pts With SMI

(McDonnell et al., 2013)

CM for Compliance in Drug Court Participants

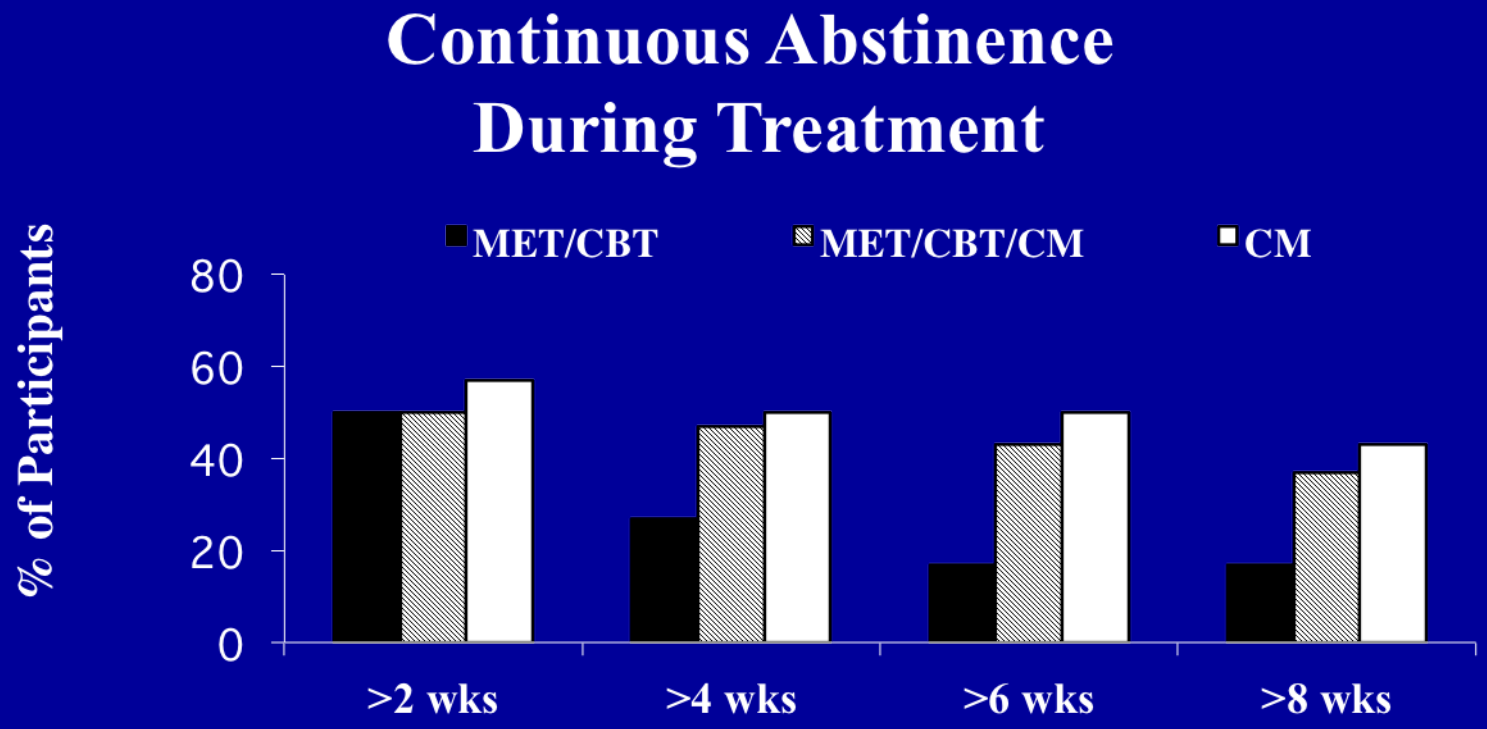
(Marlowe et al, 1997)

CM to increase Treatment Attendance in Women receiving Temporary Assistance for Needy Families

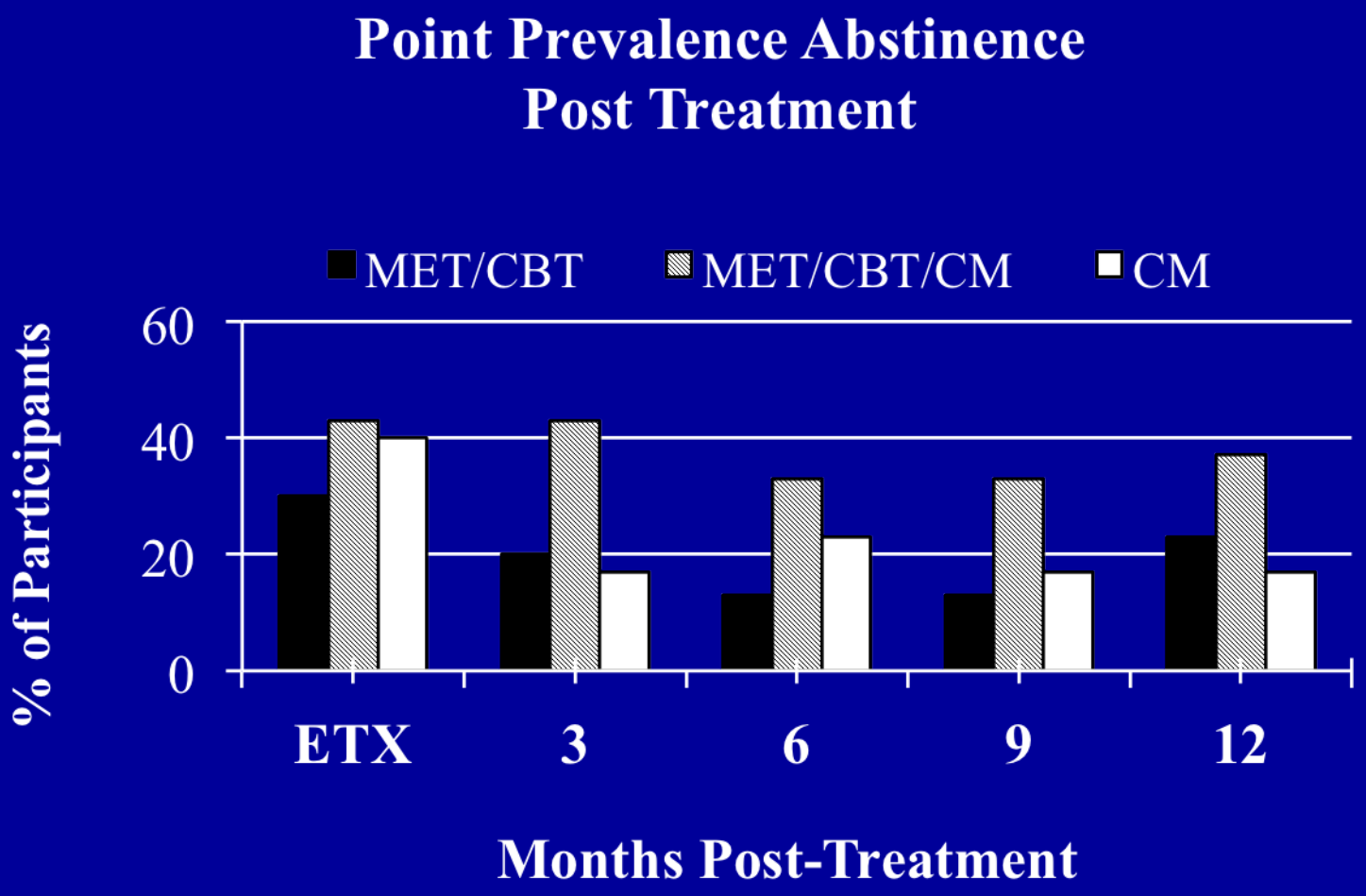
Received vouchers to purchasing items (children's toys, cosmetics, etc.) for attending treatment. (Morgenstern et al., 2006)

Adult Cannabis Dependence

Voucher Program for Marijuana Dependence



(Budney et al. 2006)



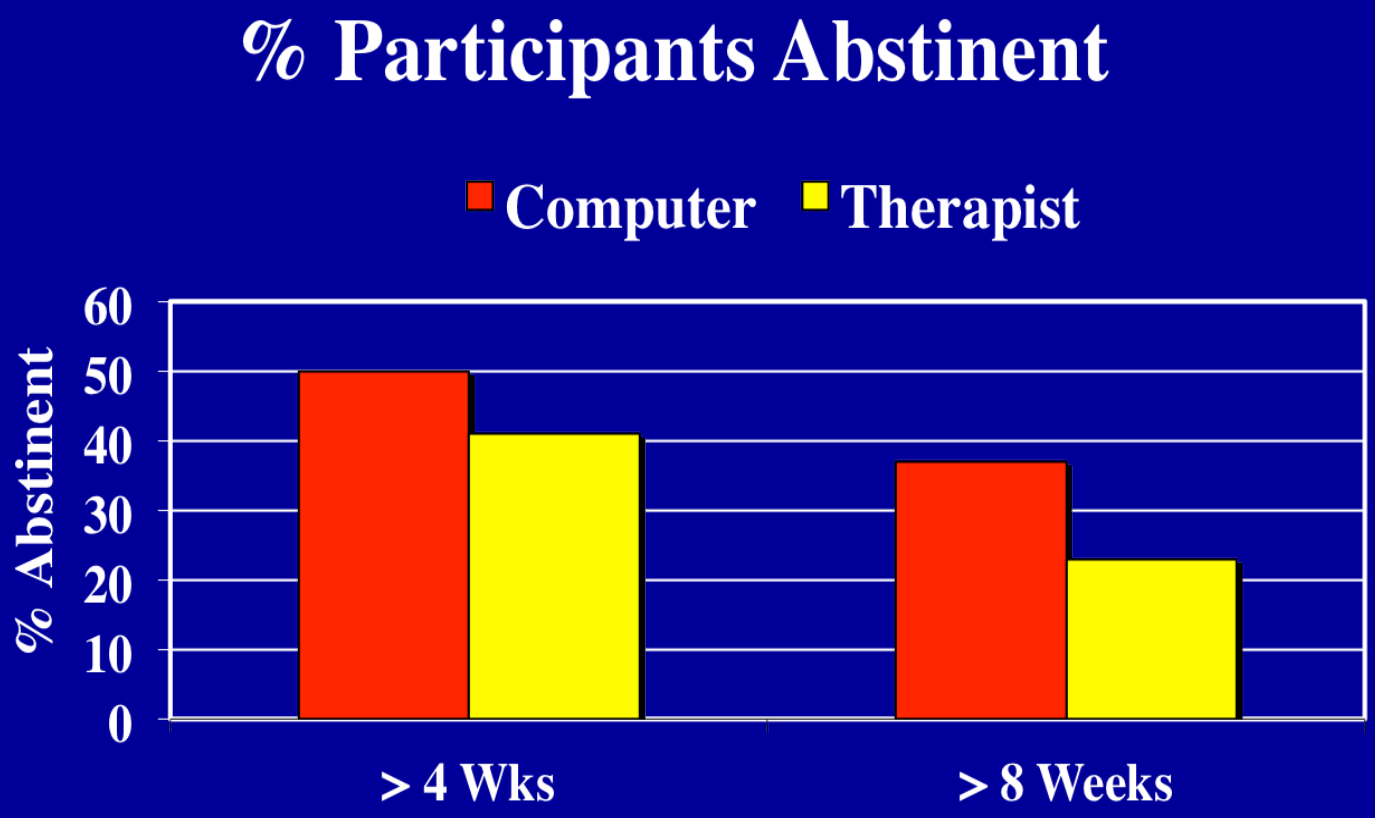
(Budney et al. 2006); replicated by Carroll et al, 2006 and Kadden et al., 2007

Computer-assisted Delivery of MET/CBT/CM for Cannabis Use Disorder

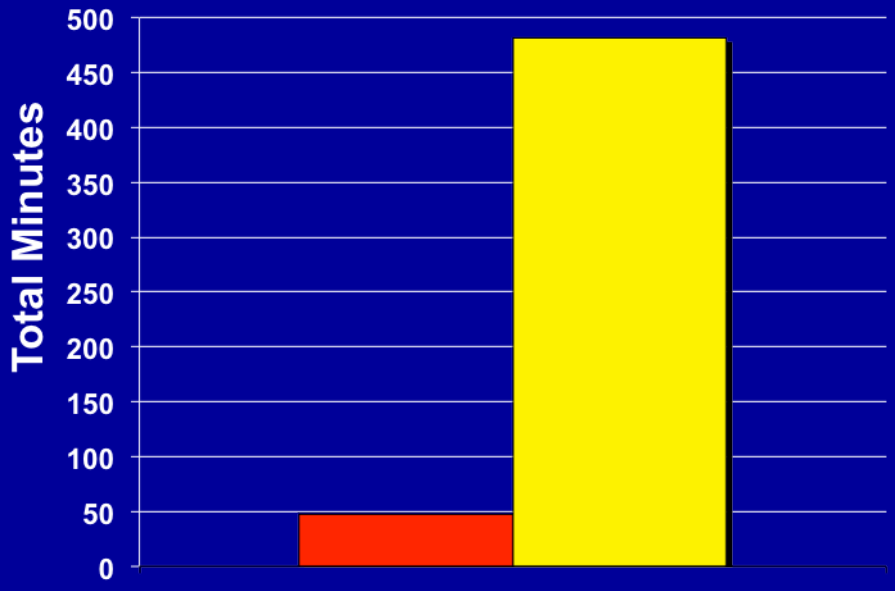
(Budney et al., 2011; in prep)

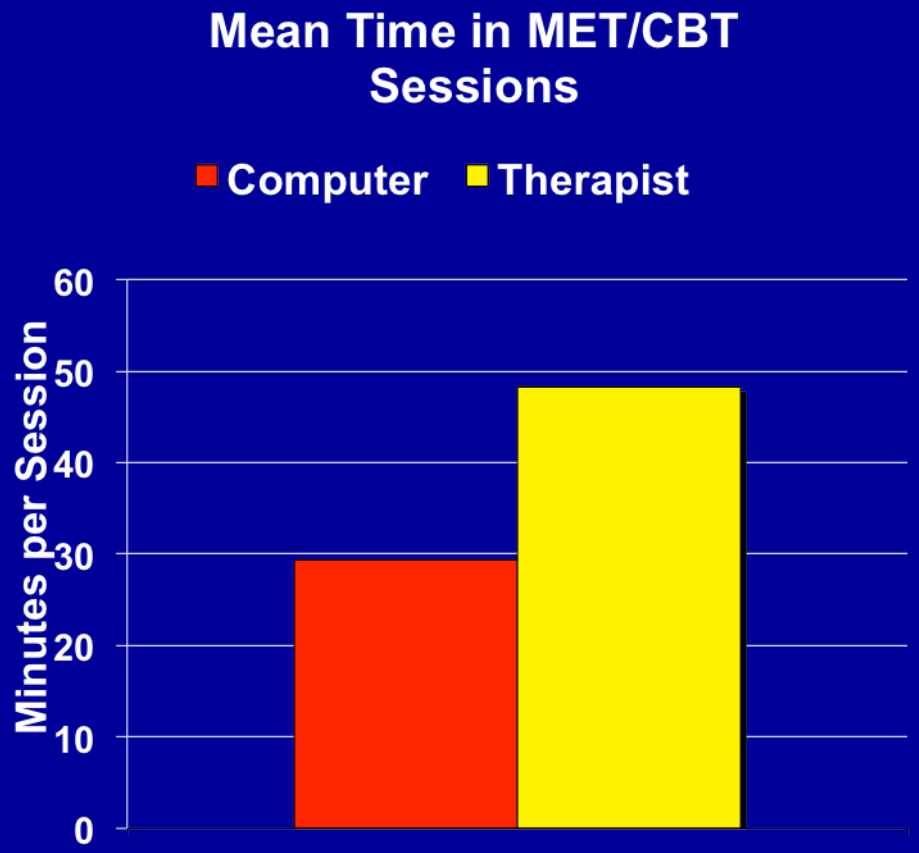
- Rationale
  - MET/CBT/CM = "gold standard" outpatient treatment
  - But, it is not readily available
  - Incentives for CM considered too costly by some
  - Training therapists to provide good MET/CBT is very difficult
  - If computer can deliver MET/CBT, cost savings from reduced cost related to therapist would help facilitate implementation

MET/CBT/CM
computer-assisted vs. therapist delivered



Cost Savings? Time (is Money)

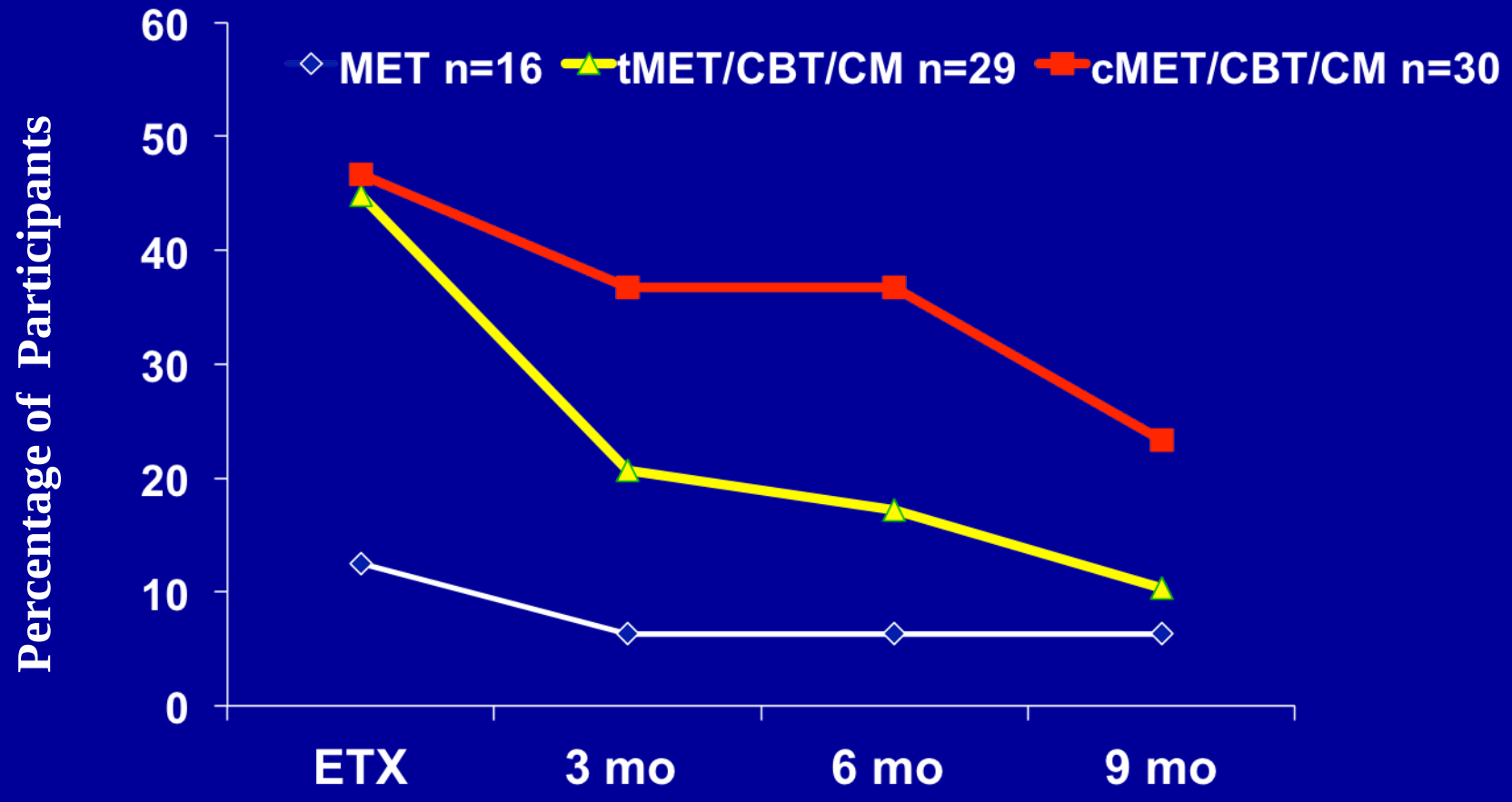




$p < .01$

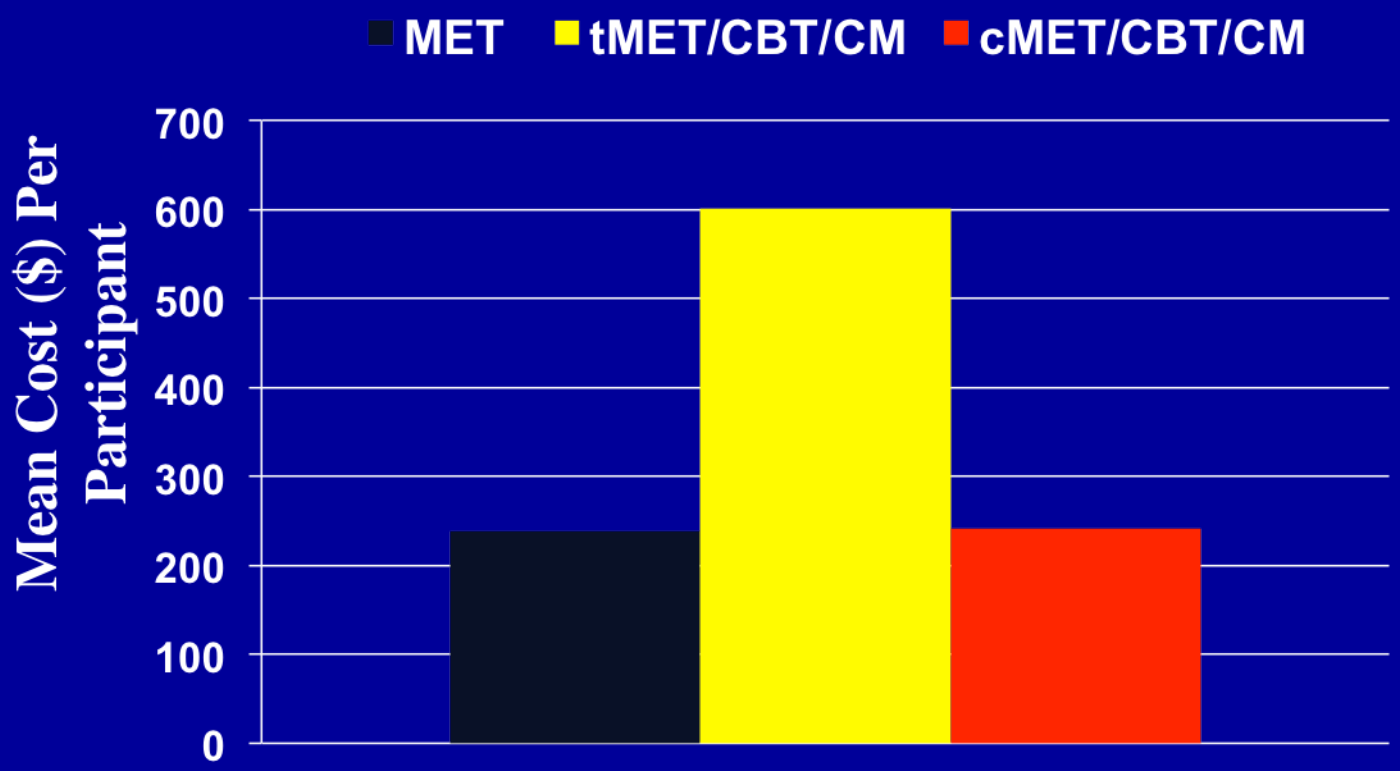
Study 2
During Treatment Abstinence

Post Treatment
Point Prevalence Abstinence



GEE Analyses: cMET/CBT/CM > MET; tMET/CBT/CM > MET

Study 2: Cost


MET
tMET/CBT/CM
cMET/CBT/CM
Mean Cost ($) Per Participant
700
600
500
400
300
200
100
0

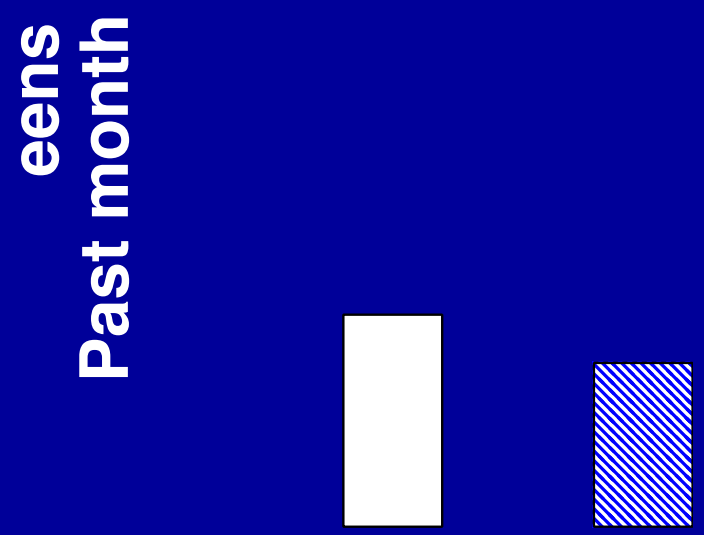
Current Project
Cannabis and Tobacco

cMET/CBT/CM plus NRT/BT for Tobacco

Contingency-Management in the Treatment of Adolescent Substance Abuse

Cannabis Youth Treatment Study
Abstinence at Discharge

(Dennis et al., 2004)



Two-Pronged Abstinence-based CM Program

A) Clinic-based Incentive Program

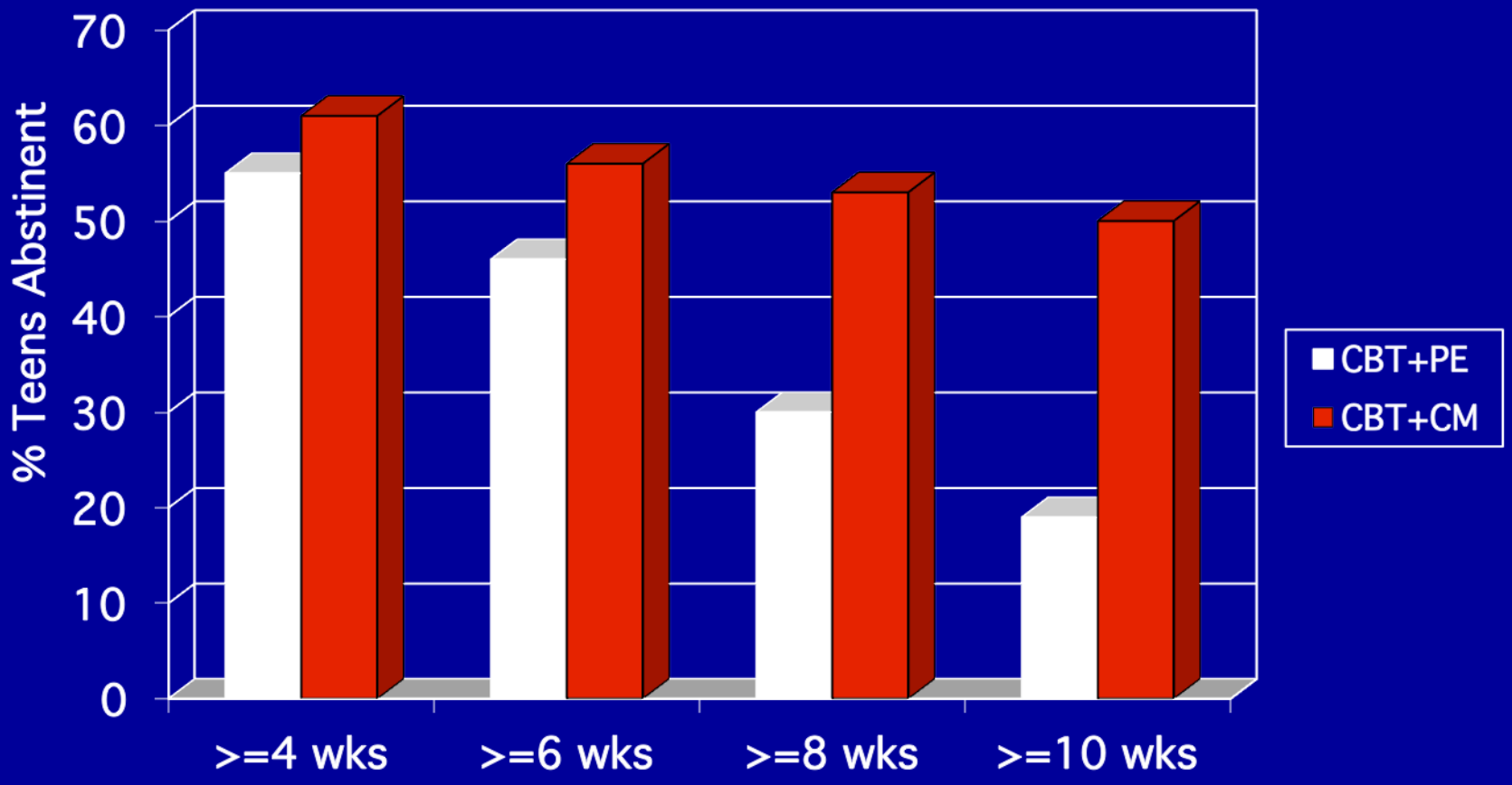
- *Schedule of Reinforcement*: escalating schedule; bonuses; reset for use (Weeks 3-14)
- *Magnitude of Reinforcement:* $590 over 14 weeks

B) Home-based CM Program - Substance Monitoring Contract

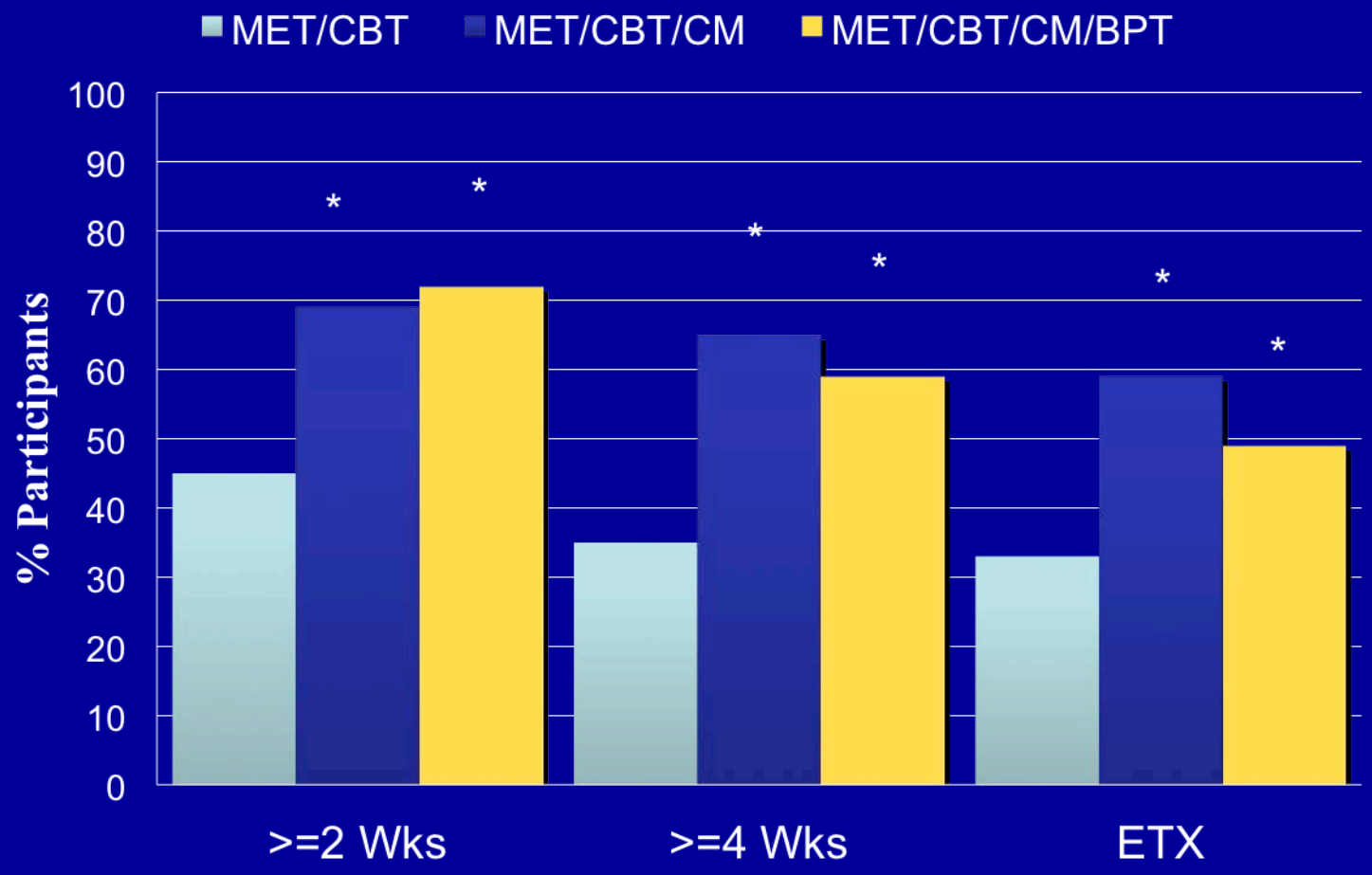
- reward for abstinence; punishment for use
- use same monitoring procedures to determine abstinence
- individualized magnitude and type of reward/consequence
- weekly ~15 min. parent sessions (incentives for adherence)

Initial Trial
Continuous Abstinence During Treatment

Stanger et al. (2009)

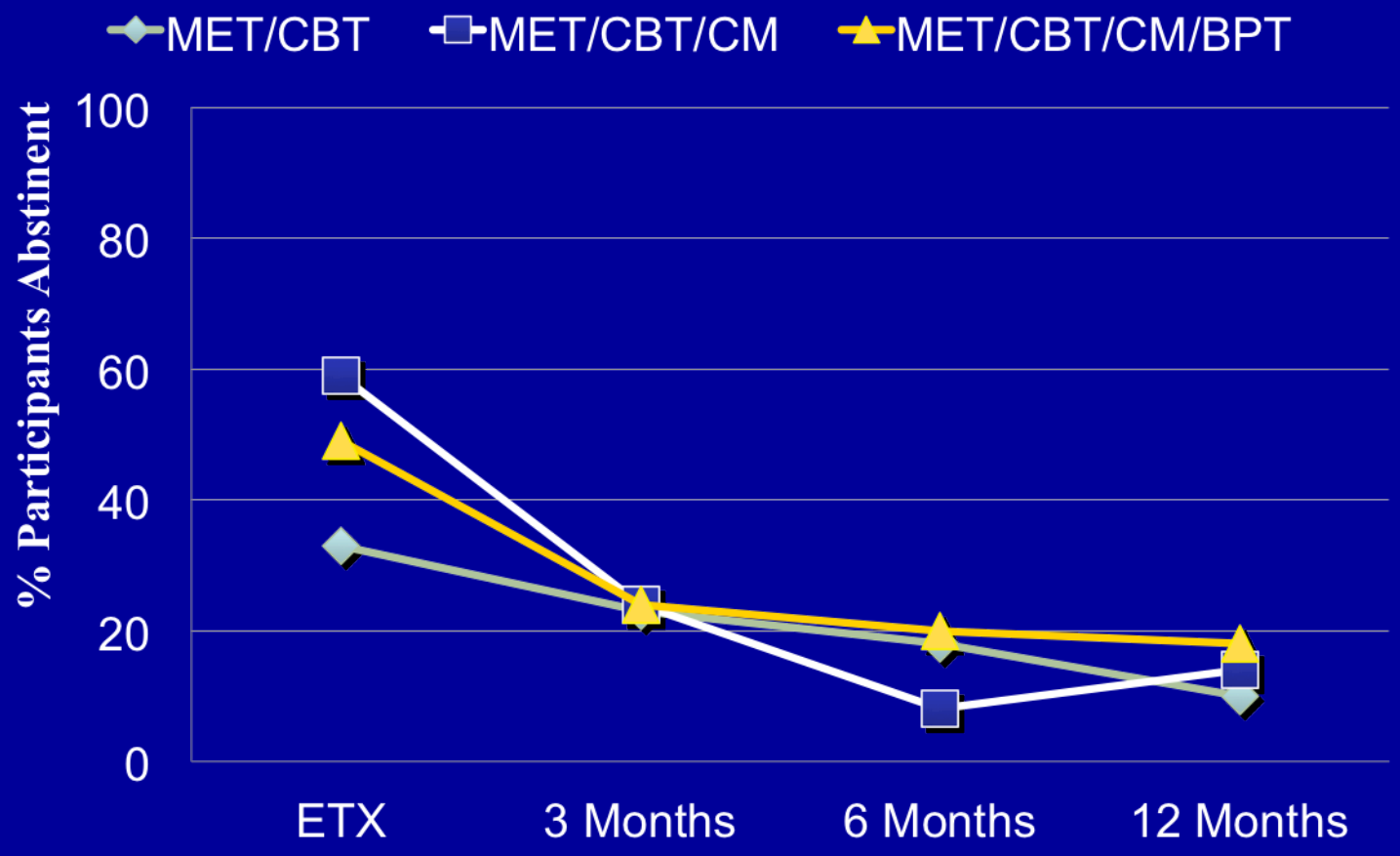


Trial II (Arkansas)
Marijuana Abstinence



* Chi Square Analyses: Both CM groups > MET/CBT ($p<.05$)

Post Treatment Abstinence
(missing specimens count as use)



Next Adolescent Project

Target Nonresponders and Impulsive-Decision Making using a SMART Trial Design

- Randomize:
  - MET/CBT/CM or MET/CBT/CM+WMT

At six weeks, re-randomize nonresponders to:

- Continue in current treatment or
- Intensified CM (increase magnitude of Rf and parent monitoring

What Do We Know?

CM is not CM is not CM....

- Many different types of CM programs
- Vary on: magnitude of Rf
  frequency of Rf
  duration
  target

What Do We Know?

- Abstinence-based CM engenders sustained periods of abstinence (alcohol, tobacco, cocaine, opiates, marijuana, methamphetamine); sustained abstinence predicts future abstinence. Short-term, temporary periods of abstinence can be beneficial
- Voucher and Prize-based CM are the two most researched types of CM with much evidence for their efficacy
- Greater magnitude incentives engender greater rates of abstinence
- Longer duration program results in longer duration positive outcomes
- Maintenance / Relapse appears equivalent to other outpatient interventions (substantial relapse)

What Do We Know?

- Effective with special populations of substance abusers, including pregnant and recently postpartum women, adolescents, homeless, and those with serious mental illness
- Cost Effectiveness / Return on Investment appears clear from a few studies, but more studies needed

Challenges

1) Maintenance .... Challenge for all interventions

  -establish meaningful lifestyle change to compete with substance use

2) Non-responders

3) Reduced use / Harm reduction

4) Schedules of Reinforcement (Incentives)

5) Individual / cultural differences impact interventions

  -nature of Rf is that it is defined by its consequences

6) Transportability / Dissemination

Challenge of Dissemination / Transportability

- Cost Effectiveness / Return on Investment
- Payor Systems
- Recognize barriers related to beliefs contrary to use of incentives (providers, administrators, policy makers, parents, general public)

  e.g., rewarding people for what they should be doing (or to stop doing what they should not be doing) is contrary to the beliefs of the masses
- Fidelity of Delivery

  incentive interventions are much more complex than they seem; details are important

Continue to Engage in Discovery: Addiction Science

- Behavioral science and neuroscience
- Technological innovations

Behavioral Economics

Produced a candidate behavioral marker of substance abuse vulnerability (Bickel et al. 2013)

Temporal (Delayed) Discounting

- Pathological Reward Processing
- Excessively Devalue Future Rewards
- Increases Value of Immediate Rewards
- more susceptible to reinforcing effects of substances and impulsive-decision making

If you devalue the future, why worry about health behaviors that have long term consequences??

Behavioral Economics

As it turns out:

In addition to most all substance using samples, high levels of Temporal Discounting associated with:

problem gambling, obesity, ADHD, schizophrenia, non-seat belt wearers, non-exercisers, poor preventive health care behavior, etc., etc.

Neurocognitive correlate: poor use of executive function / working memory

TBD: Future Orientation Therapy for Disadvantaged Youth

Components:

- Modified Incentive Program with culturally relevant incentives
- Community-based (church or community center)
- Working Memory Training
- Vocational Center (technology enhanced: future oriented)
- Recreational / learning center
- Computerized future-oriented games
- Parent programs occur in community (technology enhanced)
- Social RF from greater community….
- Treatment extenders: community health workers

THANKS!!!!

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Steve Higgins	Andrea Meier
John Hughes	Heath Rocha
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