Workshop:
Getting SMART about Developing Individualized Sequences of Health Interventions

Using SMART Design Technology to Develop an Adaptive Reinforcement-based Treatment Strategy for Pregnant Drug Abusers

Hendrée E. Jones, PhD

Senior Research Psychologist, RTI International
Adjunct Professor, Department of Psychiatry and Behavioral Sciences and Department of Obstetrics and Gynecology
Johns Hopkins University School of Medicine
Typical slide for a presentation with the title "Acknowledgements".

- **Patients and infants**
- **National Institute on Drug Abuse R01DA14979**
- **Staff at the Center for Addiction and Pregnancy**
- **Collaborators Susan Murphy, Pierre Alexander, Michelle Tuten, and Margaret Chisolm**
Outline

1. Complexities of the Problem
2. Clinical Setting
3. Role of Behavioral Treatment
4. HOME II Study
1. Complexities of the Problem

- Although pregnant women use illicit drugs less frequently than alcohol and tobacco, the women who use illicit drugs receive extraordinary scrutiny by society.

- Drug addiction almost always begins before pregnancy and in the context of past and current exposure to factors that lead to increased vulnerability.
1. Complexities of the Problem

Pregnancy can be a promising time to evaluate behavior change.
1. Complexities of the Problem

Issues Facing Pregnant Drug Users and Their Children

- Exposure to violence and trauma
- Generational drug use
- Lack of formal education
- Lack of job acquisition/maintenance skills
- Gender inequality/male-focused society
- Legal involvement
- Multiple drug exposure
- Limited parenting skills and resources
- History of child abuse and neglect
- Multiple psychiatric issues
- Unstable housing
- Lack of positive/supportive relationships
- Food insecurity/lack of nutrition
2. Clinical Setting

Center for Addiction and Pregnancy

Mission Statement

- Address Barriers to Care
- Improve maternal and infant outcomes
- Conduct clinical research to generate new knowledge to improve maternal and neonatal outcomes
2. Clinical Setting

Comprehensive Care

- **Interdisciplinary approach**
  - Psychiatry
  - Psychology
  - Obstetrics
  - Pediatrics
  - Nursing
  - Social Work

- **Multiple modalities**
  - Medically-assisted withdrawal and aftercare
  - Methadone with behavioral treatment
CAP Efficacy

<table>
<thead>
<tr>
<th>Clinical measure</th>
<th>CAP (n=100)</th>
<th>No Treatment (n=46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal visits</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>EGA (mean week)</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>% positive at delivery</td>
<td>37</td>
<td>63</td>
</tr>
<tr>
<td>Infant birth weight (grams)</td>
<td>2934</td>
<td>2539</td>
</tr>
<tr>
<td>Apgar scores (1 minute)</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>% NICU use</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Length of hospital stay (days)</td>
<td>7</td>
<td>39</td>
</tr>
</tbody>
</table>

All group comparisons are significant: $p \leq .05$

(Data adapted from Svikis et al., 1997)

2. Clinical Setting

- Investing $6,639$ in prenatal drug treatment services resulted in net savings of $4,644$ in NICU costs.

- Although CAP is cost-effective, many women continue to drop out of treatment prematurely and/or do not respond to treatment.
3. Role of Behavioral Treatment

Guiding Principles

- Drug addiction occurs in absence of alternative positive reinforcers
- Drug use behavior can be controlled using operant reinforcement procedures
- A behavior followed by positive consequences is more likely to be repeated
- Eliminate drug use by making other behaviors in a person’s environment more appealing
3. Role of Behavioral Treatment

Treatment Objectives

- Drug abstinence
- Purposeful days
- Fulfilling social relationships
- Engagement in recreational activities that compete with drug use
Example of Close Behavioral Observation:

Drug Free Days

3. Role of Behavioral Treatment

- Specific treatment goals are selected based upon counselor and patient discussions
- Larger goals are broken into smaller goals
- Positive reinforcement given for successes
3. Role of Behavioral Treatment

Example of Behavior Tracking

- Helping patients identify job interests
- Look for jobs
- Develop resume
- Practice Interviewing
- Complete applications
Examples: Sally Summer’s Treatment Progress

3. Role of Behavioral Treatment
3. Role of Behavioral Treatment

- 3 randomized trials showing RBT’s efficacy in nonpregnant patients
- 1 RBT adaptation and test in pregnant patients
- As with any intervention, not all RBT-treated participants attended treatment or reduced drug use, suggesting that further modifications to RBT are needed to improve patient response

(Gruber et al., 2000; Jones et al., 2005; Jones 2011; Tuten et al., under review)

*All treatment condition comparisons are significant at $p \leq .05$
3. Role of Behavioral Treatment

An adaptive intervention trial would answer two questions:

- Would variants of RBT that differed in terms of their intensity and scope be effective?

- Would patients who differed in terms of their treatment compliance be differentially responsive to these variants of RBT?
HOME II

Inclusion Criteria:

- Evidence of cocaine and/or opiate use
- Treatment entry at or before 32 weeks EGA with singleton fetus
- Completion of the eight-day residential detoxification stay

Exclusion Criteria:

- Age 17 or younger
- Geographical Constraints
- Severe medical or psychiatric concomitant condition interfering with treatment or needing hospitalization
4. A SMART Trial at HOME

Primary Outcomes - Maternal:

- Treatment Completion (Delivery)
- Heroin Use
- Cocaine Use

Secondary Outcomes - Neonatal:

- Neurobehavioral Functioning
- Birth weight
- Head Circumference
- Length of Hospital Stay
- Urine Toxicology at Delivery
- Physical Birth Parameters
- Neonatal Complications
Challenges in Designing the Trial:

- How to choose a design structure that would best answer questions of interest
  - Initial randomization conditions?
  - Second randomization to what combination of treatment conditions?

- Which patient characteristic to focus on that
  - Was strongly related to outcome?
  - Would allow reasonable tailoring?

- Length of time to allow for assessment of the tailoring variable – Pregnancy time-limited window

Solutions:

- **Initial Randomization:** Compare RBT to an alternate, potentially more cost effective RBT intervention rather than some other behavioral intervention

- **Treatment Compliance as the tailoring variable:** Failure to comply with treatment soon after treatment entry the biggest reason for failure to complete treatment

- **Assess compliance during the first two weeks following treatment entry**
4. A SMART Trial at HOME

- **HOME II** uses a dynamic treatment regimen that adjusts in intensity or scope following patients’ initial treatment compliance or non-compliance.

- It is expected that providing RBT in an adaptive intervention format will optimize both maternal treatment and birth outcome benefits for both early compliant and early non-compliant participants by matching treatment services to patient needs.

---

**Planned Sample Size**

- **All non-methadone CAP Patients**
  - N=300

- **Random Assignment**
  - **tRBT** n=150
  - **rRBT** n=150

- **Tailoring Variable Randomization:**
  - **Early Compliant** r=90
  - **Early Non-Compliant** r=90

- **Group Assignment**
  - A: rRBT n=45
  - B: tRBT n=45
  - C: rRBT n=30
  - D: eRBT n=30
  - E: rRBT n=45
  - F: rRBT n=45
  - G: rRBT n=30
  - H: aRBT n=30

**Legend:**
- tRBT = treatment-as-usual RBT
- rRBT = reduced RBT
- eRBT = enhanced RBT
- aRBT = abbreviated RBT

*Early compliance response rate of 60% based on preliminary studies.*
4. A SMART Trial at HOME

**tRBT: Treatment-as-usual RBT**

- All elements of treatment-as-usual RBT
  - Several key RBT elements are provided at a reduced scope in order to examine a version of RBT that might be more in line with competing demands on time and resources a community therapist might face in treating his/her patients
  - Less frequent individual sessions
  - Recreation and job club reduced to one a week

**rRBT: reduced RBT**

- All elements of treatment-as-usual RBT
  - Several key RBT elements are provided at a reduced scope in order to examine a version of RBT that might be more in line with competing demands on time and resources a community therapist might face in treating his/her patients
  - Less frequent individual sessions
  - Recreation and job club reduced to one a week
4. A SMART Trial at HOME

Tailored Treatment Randomization

Two-week window for treatment response

- Early compliant participants randomized to either the same intensity of treatment or a decreased intensity or scope of RBT treatment
- Early non-compliant participants randomized to receive either the same treatment or a greater intensity or scope of RBT

Early treatment non-compliance:
(a) a missed unexcused treatment day,  
(b) a positive opioid or cocaine urine specimen,  
(c) or self-report of use of either drug.
4. A SMART Trial at HOME

**eRBT: Enhanced RBT**

All tRBT elements, plus:

- Therapists visit the participant in the community to perform urine drug screening. If positive:
  - Therapy sessions that include a functional analysis will be provided
  - Immediate re-admission to the residential unit to “time out” from drug use and to once again achieve abstinence

**aRBT: Abbreviated RBT**

Most reduced version of RBT:

- Graphing only drug abstinence
- No tangible reinforcers
- Outreach performed less proactively
- Individual therapy sessions once a week
- Recreation and social club once a month
Hypothesis 1: B+C v. F+G

- Relative efficacy of providing continued treatment-as-usual RBT in comparison to continued reduced RBT to both early-compilers and early non-compliers throughout the trial.

- Therefore, this hypothesis addresses the question of whether it is necessary to provide treatment-as-usual RBT, or if it is possible to successfully treat patients with reduced RBT, regardless of the patient’s level of compliance.
Hypothesis 2A: C v. D
Hypothesis 2B: E v. F

- Relative efficacy of transitioning to a more intensive level of treatment for early-non-compliers within the initial treatment-as-usual RBT and reduced RBT treatment conditions, respectively.

Therefore, this pair of hypotheses answers questions regarding the relative importance of the initial level of care in determining the efficacy of transitioning to a higher level of care for early-non compliers.
Hypothesis 3A: A v. B
Hypothesis 3B: G v. H

- Relative efficacy of transitioning to a less intense level of treatment for early-compliers within the initial treatment-as-usual RBT and reduced RBT treatment conditions, respectively.

► Therefore, this pair of hypotheses answers questions about the importance of the initial level of RBT treatment in determining success in subsequently reducing the level of RBT treatment in early-compliers.
Hypothesis 4A: B v. C
Hypothesis 4B: F v. G

- Relative efficacy for early-complier and early-non-compliers who begin and continue in treatment-as-usual RBT or who begin and continue in reduced RBT, respectively.

► Therefore, these two hypotheses answer the question about the relative decrement in treatment success that occurs as a result of an early failure to comply with the initial demands of treatment.
Current Enrollment

All non-methadone CAP Patients
N= 50

Random Assignment

tRBT n=25

Early Compliant n=13
Decrease Intensity
rRBT n=6

tRBT n=7

Early Non-Compliant n=12
Increase Scope
tRBT n=6

eRBT n=6

Early Compliant n=14
Decrease Scope
rRBT n=7

tRBT n=7

Tailoring Variable Randomization:
Treatment Compliance

4. A SMART Trial at HOME
4. A SMART Trial at HOME

Challenges in Conducting the Trial

- Recruitment
- Adherence of the clinical staff to the protocol
- Changing clinical context

New Insights Resulting from the Trial

- Patient acceptance of the tailoring treatment randomization
- Better-than-expected distribution of patients into tailoring treatment randomization
For More Information

Hendrée E. Jones, PhD
email: hjones@rti.org
voice: 1-919-485-2664

A complete reference list for the presentation is available upon request