COPE Webinar for Health Professionals
Feeding the Need, Developing Solutions Webinar Series

Can we predict who will lose weight and keep it off long-term?: Using Data-Driven Approaches to Inform Obesity Treatment

September 22, 2021
Moderator
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See Danielle Ostendorf, PhD webinar description page for pdfs of today’s slides

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October 6, 2021

• Part 1. Exploring Race, Social Equity and Justice in Health Care: An Interdisciplinary Conversation
  1:30 PM
  • Teresa Turner, MS, RD, LDN, SNS, FAND
  • Cheryl Dennison Himmelfarb, PhD, RD

• Part 2. Best Practices for Culturally Sensitive Recipe Development
  5:30 PM
  • Breana Lai Killeen, MPH, RD
  • Tessa Nguyen, RD, LDN

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Today’s Webinar Objectives

▣ Identify reasons for inter-individual variability in response to weight loss interventions
▣ Understand factors influencing long-term weight maintenance and weight gain
▣ Discuss implications for future interventions and obesity treatment strategies

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- Level 2
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Disclosures

The planners and presenter of this program have no conflicts of interest to disclose.

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Outline

- Challenges in obesity prevention and treatment: inter-individual variability
- Discuss the value of using data-driven approaches to study this variability
- Describe the behavioral weight loss trial, intervention, and study participants
- Describe the statistical analysis
- Share the primary study findings
- Implications for future interventions and obesity treatment strategies

Epidemiology of Obesity

Prevalence of Overweight and Obesity Among US Adults, Ages 20-74 Years

SOURCE: NCHS, National Health and Nutrition Examination Survey. Age-adjusted by the direct method to the year 2000 U.S. Bureau of the Census estimates using the age groups 20-34, 35-44, 45-54, 55-64, and 65-74 years.
Challenges in Obesity Treatment

- Weight loss is hard
- Weight loss maintenance is even harder

80% of lost weight regained

85% of lost weight regained

40% of lost weight regained

35% of lost weight regained

Adapted from Anderson et al., (2001) AJCN.

Why is Obesity Treatment So Challenging?

- Individual variability in response to treatment(s)
- Individual differences in program adherence
- Physiological adaptations of counter regulatory mechanisms that promote weight regain
- Obesogenic environment

Why is Obesity Treatment So Challenging?

Conceptual Framework

Adaptive Response to Weight Loss

Target Domains

Sociodemographics – Biology – Psychology – Environment – Behaviors

Adaptive Response to Behavior

Moderators

Mediation of the treatment effect

Adaptive Feedback to the target domains

Adherence

Interplay, with mediating or moderating effects

Traditional Analytical Approaches in Obesity Research

Application of Data-Driven Approaches in Obesity Research

Identifying Weight Loss Trajectories: Lifestyle Weight Loss Interventions

Data-driven approaches:

- Identify multiple unobserved sub-populations in the sample who demonstrate similar patterns of weight change over time
- Can describe longitudinal change within each unobserved sub-population
- Allow us to examine differences between sub-populations

Application of Data-Driven Approaches in Obesity Research

Identifying Weight Loss Trajectories: Lifestyle Weight Loss Interventions

- n=231 adults (primarily white, female) who received a 12-mo dietary weight loss program
- Rapid losers and maintainers were older and had lower BMIs compared to recidivists

- n=604 Black American adults (primarily female) who received a lifestyle weight loss program
- Having a higher BMI predicted having pattern 2 or 3; higher dietary fat score predicted lower odds of having patterns 2 or 3

- n=494 Black American adults (primarily female) who received a lifestyle weight loss program
- Having a higher BMI predicted having pattern 2 or 3; higher dietary fat score predicted lower odds of having patterns 2 or 3

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- Having a higher BMI predicted having pattern 2 or 3; higher dietary fat score predicted lower odds of having patterns 2 or 3
Identifying Weight Loss Trajectories: Bariatric Surgery

- n=2348 adults (n=1738 RYGB, n=610 LAGB) who received a lifestyle weight loss program
- RYGB: female, younger age, white race, smoking, higher BMI, not having diabetes, not having low HDL cholesterol, not having hypertension
- Blue text = LAGB

Research Gap

- Few studies have examined a comprehensive array of factors that predict weight change trajectories
- Exploratory analyses are a critical first step towards developing tailored interventions to promote long-term weight loss maintenance

Research Aims

- Identify groups of individuals with distinct patterns of weight change over 24 months
- Explore differences between groups in sociodemographic, biologic, behavioral, and psychosocial factors

Randomized Controlled Weight Loss Trial – “Exercise Timing Study”

<table>
<thead>
<tr>
<th>Time</th>
<th>Standard Diet Only</th>
<th>Standard Diet + Supervised Exercise</th>
<th>Standard Diet + Unsupervised Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mo.</td>
<td>Reduced Calories</td>
<td>Reduced Calories + Supervised Exercise</td>
<td>Reduced Calories + Unsupervised Exercise</td>
</tr>
<tr>
<td>6 mo.</td>
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<tr>
<td>12 mo.</td>
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<tr>
<td>18 mo.</td>
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When is the Optimal Time to Add Exercise in a Behavioral Weight Loss Intervention?

- Standard
- Sequential

NIH Grant funded by NIDDK (R01 DK097266); NCT01985568; PI Victoria Catenacci, MD
AHA Pre-Doctoral Grant to obtain 24 month measures (AHA 16PRE29660012; PI Danielle Ostendorf, PhD)

Ostendorf et al. (2021) Obesity Science & Practice

Courcoulas et al., (2018) JAMA Surgery
Exercise Timing Behavioral Weight Loss Intervention

**Curriculum**
- Colorado Weigh – skills based approach and cognitive behavioral strategies for lifestyle modification
- Led by Registered Dietician
- Weekly classes for weeks 0-20, every other week for weeks 21-26, and every month for weeks 27-78

**Dietary Prescription**
- Suggested macronutrient content: 50-55% carbohydrates, 20-25% protein, 20-30% fat
- 1200-1800 kcal/day based on estimated energy requirements (Mifflin St. Jeor)

Exercise Timing Physical Activity Prescription

**Prescription**
- Gradually increase moderate intensity activity to 300 minutes/wk over 6 month supervised exercise phase, and maintain this level for study duration
- 65-75% Heart Rate Maximum
- Technogym Wellness System Key
- Membership to the Anschutz Health and Wellness Center
- Could choose between treadmill, elliptical, recumbent or upright bikes, rower, stepper, or arm ergometer

Behavioral Support
- Structure:
  - 45-min 1:1 support session using standardized curriculum

Timing of Exercise Initiation did not Influence Long-term Weight Loss

- Adults randomized to standard demonstrated greater weight loss at 6 months vs. sequential, but no differences at 18 months
- Both immediate and delayed exercise initiation resulted in clinically meaningful weight loss at 18 months
- Timing of exercise initiation can be based on patient preference

Outcome Measures

<table>
<thead>
<tr>
<th>Month</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
<th>18</th>
<th>21</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Weight (calibrated digital scale at clinic)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Fat Mass, Fat Free Mass (DIA)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>Cardiorespiratory Fitness (VO2 Max Test)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>Energy Intake and Macronutrient Content – 3 day diet diary</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
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<td>MIA (Sensewear Mini Armband)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<td>Self-efficacy for Exercise (BARSSE)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Perceived Benefits and Barriers of Exercise (DBBS)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Exercise motivation (BREQ-2)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Eating and Bingeing (WHEL)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>Cognitive restraint, hunger, disinhibition (TTEI)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Weight management behavior (EBBS)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Motivation for engaging in weight loss treatment (YSRQ)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>Depressive symptoms (CES-D)</td>
<td>x</td>
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</table>

Statistical Analysis

- Identified distinct clusters of longitudinal weight change trajectories over 24 months (latent class growth mixture model)
- Estimated models estimated iteratively – we increased the number of clusters until the best fitting model was found
- Selected the best fitting model based on the model with the lowest Bayesian Information Criterion (BIC) (models with clusters <10 not considered)
- Explored whether baseline levels or change in different factors were associated with trajectory group
Results: Identified 2 Weight Trajectory Groups

Baseline Characteristics by Trajectory Group

Baseline Factors and Trajectory Groups

Ostendorf et al. (2021) Obesity Science & Practice

Ostendorf et al. (2021) Obesity Science & Practice

Ostendorf et al. (2021) Obesity Science & Practice

Average Energy intake (kcal/d)  VO₂ Max (L/min)

Average Energy intake (kcal/d)  VO₂ Max (L/min)

Average Energy intake (kcal/d)  VO₂ Max (L/min)
Discussion

Race: A Significant Predictor of Weight Loss/Weight Loss Maintenance
- Black participants (predominantly women) tend to lose less weight as compared to White participants.
- Look AHEAD – weight loss at 1 year was significantly lower in Black (-6.8%) compared to non-Hispanic White participants (-9.0%).
- But no racial/ethnic differences by year 4.
- Black adults have higher rates of obesity and obesity-related comorbidities (diabetes, CVD).
- Potential biological, behavioral, and sociocultural factors.

Racial Differences: Sociocultural
- Black participants achieved similar weight loss to White participants, when Black participants made up >50% of the total sample.
- Natural alteration of group dynamics and interpersonal relationships.
- What about cultural adaptations?
  - Some studies show enhanced weight loss and weight loss maintenance in Black participants.
  - Others show no additional impact.
  - In the present study – 90% Black, 68% White, 61% Hispanic were classified as regainers.

Racial Differences: Biological
- Delay and Colleagues: longitudinal changes in body weight and energy expenditure (GE) during a 6-month weight loss intervention.
  - n=25 White and Black female matched pairs.
  - White achieved similar weight loss to Black participants.
  - % Black: 55% Primary Caucasian 100% 11% 8%.

Potential biological, behavioral, and sociocultural factors.

Summary of Baseline Predictors of Trajectory Groups

<table>
<thead>
<tr>
<th>Study Characteristics</th>
<th>Present Study</th>
<th>Elsewhere in et al.</th>
<th>Morales et al.</th>
<th>Cresswell et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>n=376</td>
<td>n=494</td>
<td>n=178 (95% CI)</td>
<td>n=60 (2/3)</td>
</tr>
<tr>
<td>Average Age</td>
<td>40.0 years</td>
<td>47.0 years</td>
<td>47.0 years</td>
<td>40.0 (5/2)</td>
</tr>
<tr>
<td>Gender</td>
<td>81% Female</td>
<td>75% Female</td>
<td>80% Female</td>
<td>66% 15%</td>
</tr>
<tr>
<td>Average BMI</td>
<td>34.4 kg/m²</td>
<td>31.3 kg/m²</td>
<td>37.0 kg/m²</td>
<td>47 (±5.2)</td>
</tr>
<tr>
<td>% Black</td>
<td>15%</td>
<td>10%</td>
<td>100%</td>
<td>11% 8%</td>
</tr>
</tbody>
</table>

Psychosocial Differences at Baseline
- Regainers started intervention with:
  - Lower perceived barriers for exercise
  - Higher intrinsic motivation for exercise (enjoyment)
  - Higher eating self-efficacy
  - Lower hunger
  - Lower depressive symptoms
  - Did regainers over-estimate their confidence in ability to eat healthy foods?!
  - Ceiling effect
- If replicated in larger samples – we may be able to identify individuals who may need alternative behavioral support or adjunctive therapies.

Potential biological, behavioral, and sociocultural factors.
Importance of Physical Activity

- Maintainers demonstrated significantly greater increases in MVPA performed in bouts of at least 10 minutes compared to regainers.
- High levels of PA (250-300 min/week) are critical for weight loss maintenance.
- Maintainers performed ~300 min/week of MVPA in bouts at 24 months.
- Regainers performed 215 min/week of MVPA in bouts at 24 months.


Motivation for Exercise: A Self-Determination Theory Perspective

- Increases in autonomous motivation were associated with long-term weight loss maintenance.
- Valuing benefits from exercise.
- Enjoying exercise.

Future Intervention Implications:
- Allow participants to choose their:
  - Physical activity type (walking, gardening etc.)
  - Location (more aesthetically pleasing settings like a hike in forest or along a beach)
  - Intensity (light vs. moderate vs. vigorous)
  - Duration
  - Make it fun!!

1 Ostendorf et al. 2021 Obesity Science & Practice

Barriers for Exercise

- Decreases in barriers for exercise were associated with long-term weight loss maintenance.
- Time
- Energy levels
- Resources (distance to fitness center, park)
- Social aspects (feelings of embarrassment, lack of social support)

Future Intervention Implications:
- Strategize with participants in how to fit activity into daily routine.
- Start with light intensity for those new to exercise.
- Create social support groups.

1 Ostendorf et al. 2021 Obesity Science & Practice

What about diet?

- The present study found no association with energy intake and weight trajectory group.
- Zheng and colleagues found that eating-related factors were associated with favorable weight loss trajectories:
  - Reductions in perceived barriers to healthy eating
  - Lower fat intake
  - Limitations with self-reported energy intake – error and misreporting

1 Zhang et al. 2017 J Acad Nutr Diet. 2 Dhurandhar 2015 Int J Obes
Diet-related psychosocial factors

- Weight loss maintainers demonstrated significant improvements in
  • Eating self-efficacy
  • Cognitive restraint (tendency to consciously restrict food intake)
  • Disinhibition (tendency to overeat)
  • Engagement in weight management behaviors
  • Eating self-efficacy is an important predictor of weight control behaviors (restricting energy intake)
- Increases in cognitive restraint and reductions in disinhibition during a weight loss intervention are associated with long-term weight loss maintenance

References:

Limitations

- Secondary, exploratory data analysis
- Small sample size – high variability within the 2 trajectory groups
- Sample is not generalizable (majority white women)
- Self-reported dietary intake data

Strengths

- 79% of participants provided at least 6 weights over 24 months
- Comprehensive examination of several biologic, behavioral, and psychosocial factors recommended by the Accumulating Data to Optimally Predict obesity Treatment (ADOPT) project
- Data-driven approach

Implications for Future Research

- Planned assessments and analyses of additional factors:
  • Biologic:
    - Resting energy expenditure
    - Total daily energy expenditure (doubly labeled water)
    - Hormones related to appetite and hunger
  • Behavioral:
    - Sleep
  • Psychosocial:
    - Stress
    - Personality
  • Environment:
    - Perceptions of Crime
    - Walkability
    - Food Outlets

Ongoing Obesity Research Trials at University of Colorado

Daily caloric Restriction vs. Intermittent Fasting (DRIFT-2) Weight Loss Trial (PI: Catenacci)
- n=165 adults with overweight or obesity randomized to daily caloric restriction or intermittent fasting
- All participants receive 12 months of behavioral support led by a registered dietitian
- Several biologic, behavioral, psychosocial, and environmental measures

Development of the Move Physical Activity Support Program (PI: Ostendorf)
- Based on Self-Determination Theory
- Designed to improve autonomous motivation for physical activity

TimEx Study (PI: Catenacci)
- Adults with overweight or obesity randomized to receive morning or evening exercise

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Tracy Oliver, PhD, RDN, LDN
Associate Professor, Villanova University M. Louise Fitzpatrick College of Nursing

December 15, 2021
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Nawfal Istfan, MD, PhD
Brigham and Women’s Hospital Division of Endocrinology, Diabetes and Hypertension

February 16, 2022  NEW! Small Interactive Webinar
Strategies Towards Change: More info coming soon!
Christina Whitehouse, PhD, AGPCNP-BC, CDCES
Assistant Professor, Villanova University M. Louise Fitzpatrick College of Nursing

Q&A

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