Peas and the Pod: Exploring innovative approaches to weight control and behavior change

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Overview

- Background on obesity
- Trajectory of my research path
  - Technology→Plant-based dietary approaches→Technology
- Future directions of my research

Overweight and Obesity

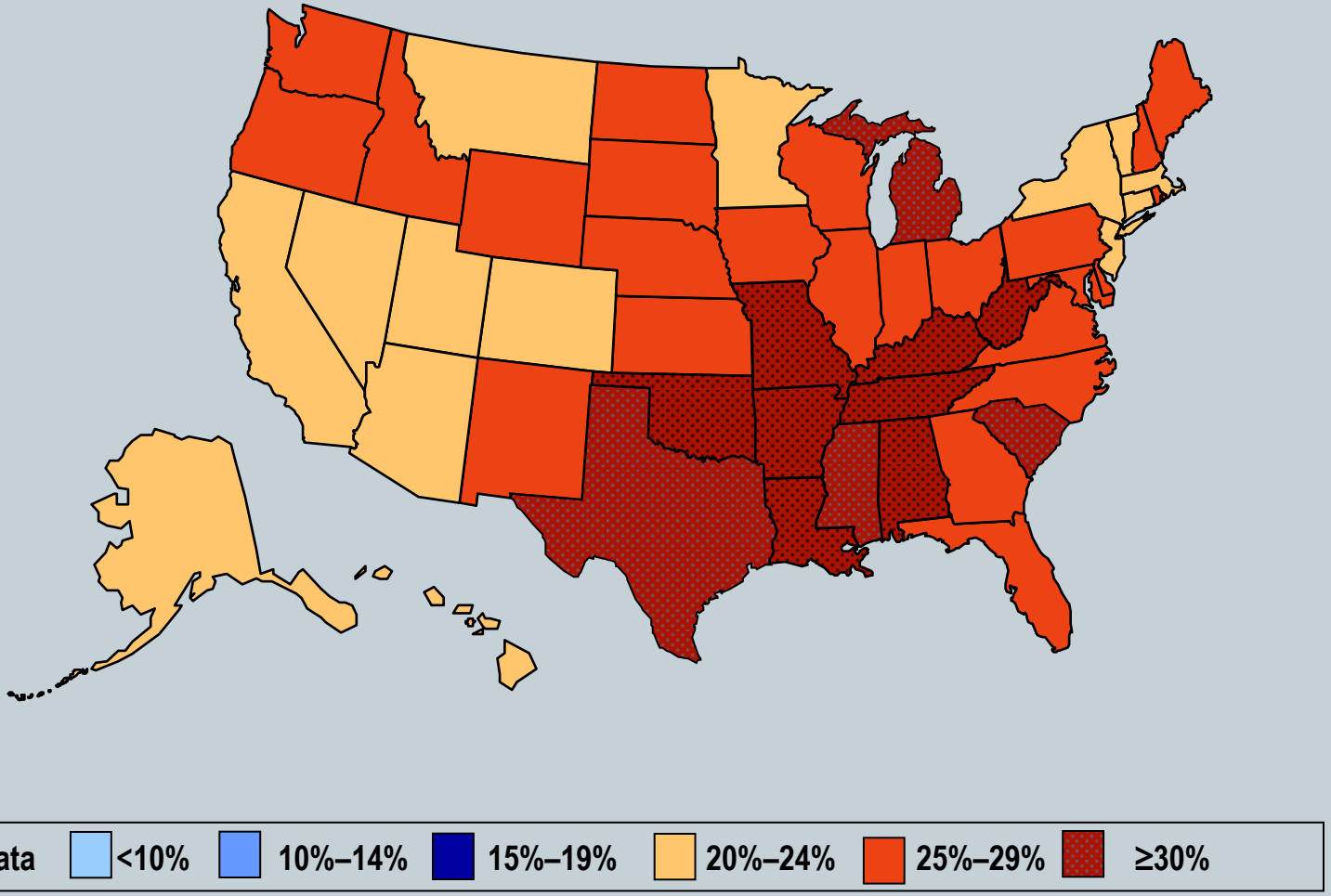
- Two-thirds of U.S. adults are overweight or obese
- 1 in 10 kids age 2-5 years old is obese
- Increased risk of:
  - Type 2 diabetes
  - Heart disease
  - Hypertension
  - Several cancers including ovarian cancer, postmenopausal breast cancer, colorectal cancer, and pancreatic cancer
- Interventions that focus on weight loss are important in that these studies can help target many types of diseases at once.

Ogden CL, et. al. *JAMA* 295:1549-1555, 2006
Calle EE, et. al. *N Engl J Med.* Apr 24 2003;348(17):1625-1638.
Cowie CC, et. al. *Diabetes Care* 29:1263-1268, 2006
Pischon T, et. al. *Proc Nutr Soc.* May 2008;67(2):128-145.
Prevalence of Obesity Among Children and Adolescents: United States, Trends 1963-1965 Through 2007-2008

Obesity Trends* Among U.S. Adults

BRFSS, 2010

(*BMI ≥30, or ~ 30 lbs. overweight for 5’ 4” person)

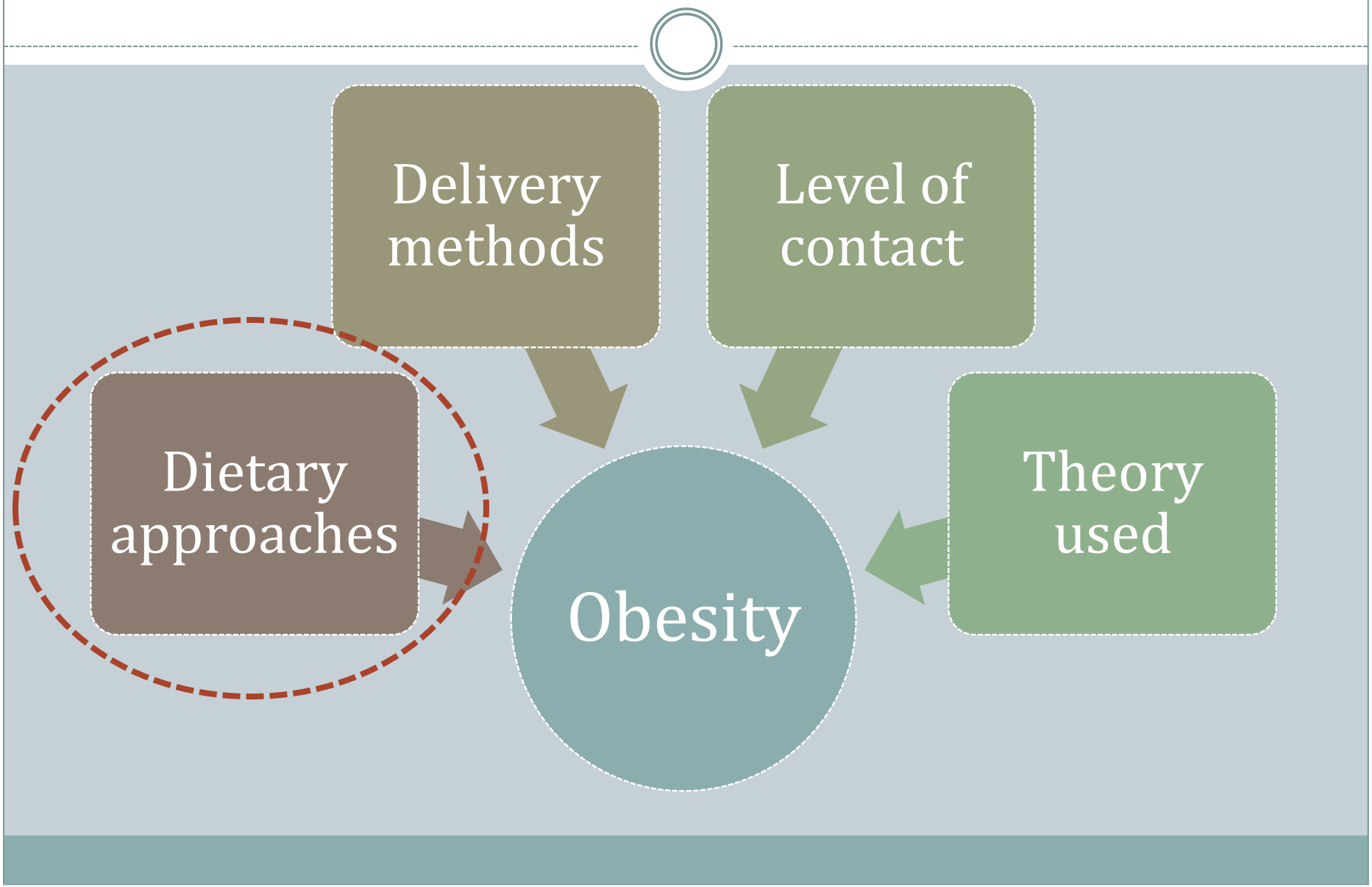


Can face-to-face interventions be delivered via remote technologies?

Prior to my doctoral work…

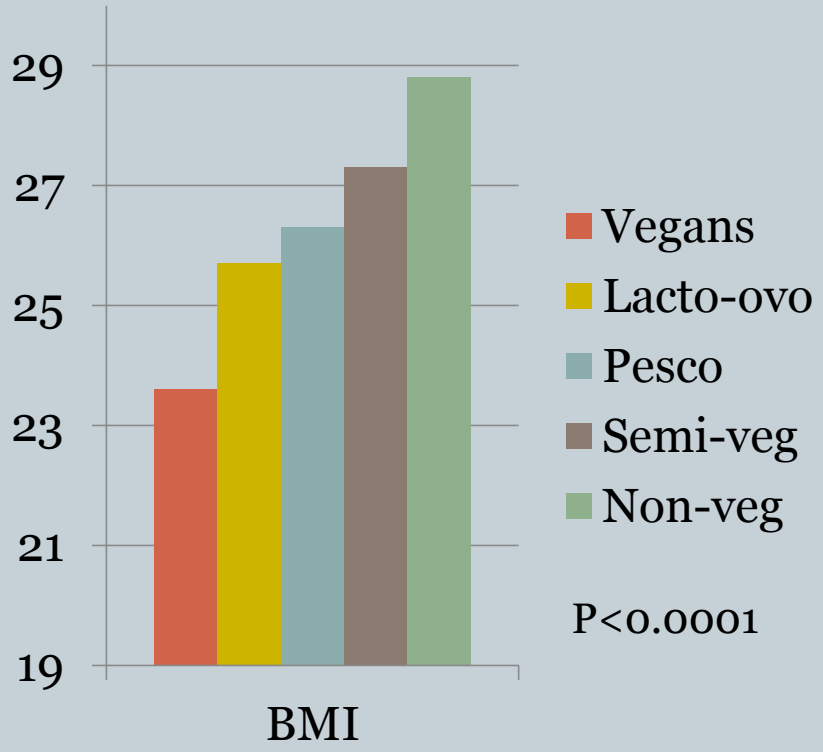
- Senior thesis, B.Phil., Miami University
  - "Exploring the use of three different bandwidths of interactive television for counseling sessions conducted in sign language."
- Master's thesis, M.S. Human Environmental Science, University of Alabama
  - "Comparing knowledge gained from a nutrition education session on increasing fruits and vegetables conducted via interactive television or face-to-face."

Aspects of weight loss intervention research

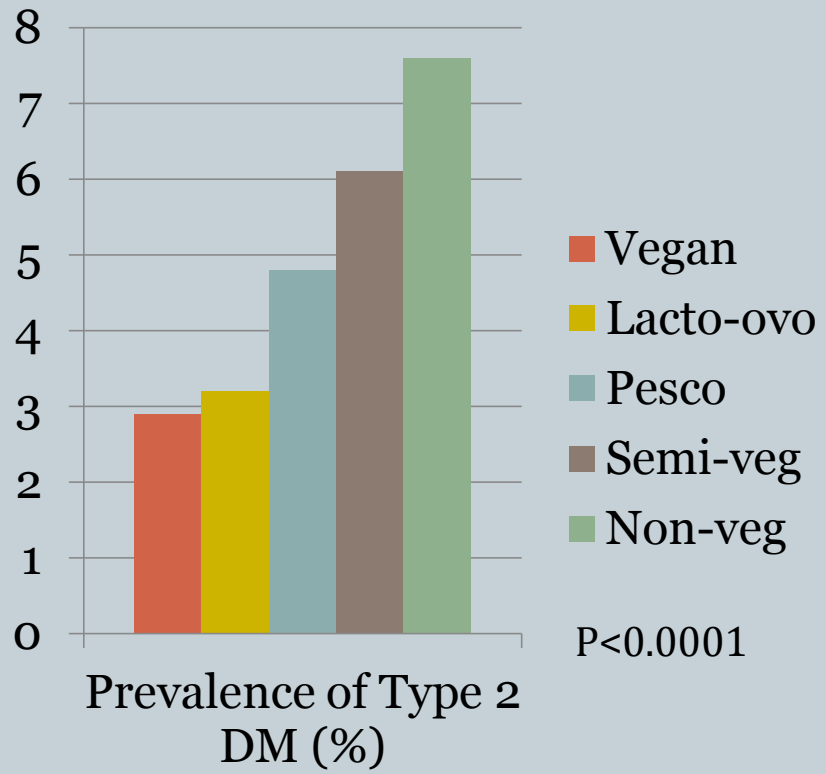


Plant-based dietary approaches

Type of vegetarian diet and body weight

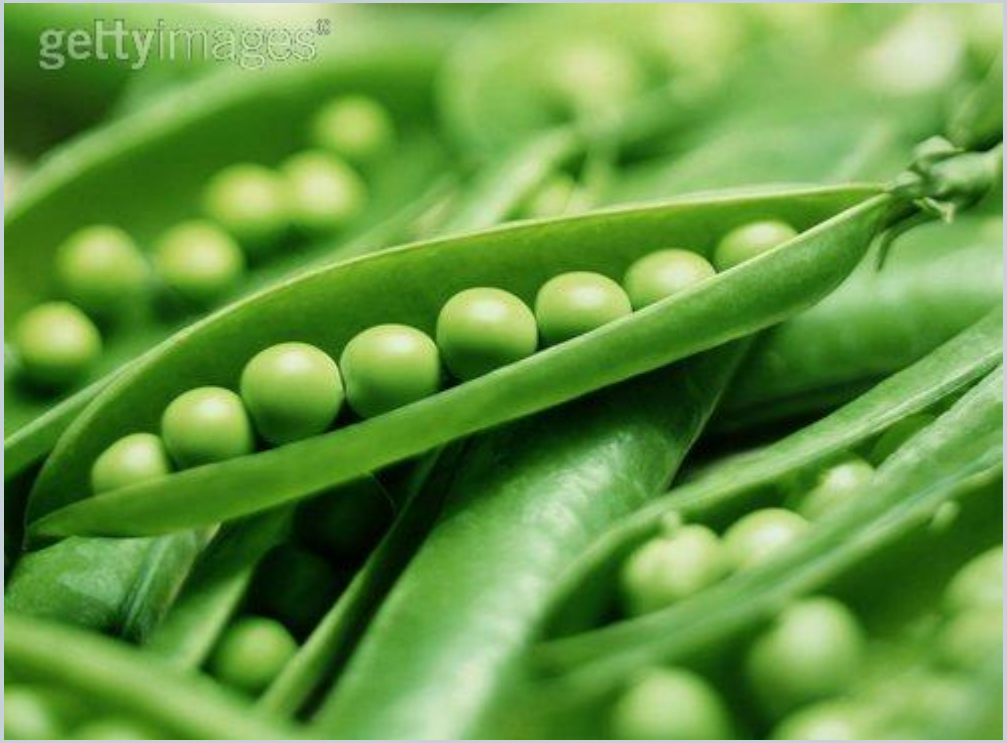


Type of vegetarian diet and prevalence of type 2 DM



Tonstad S, Butler T, Yan R, Fraser GE. Diabetes Care. 2009 May;32(5):791-6.

Does transitioning to a plant-based diet produce more weight loss than a standard low-fat diet?



Plant-based dietary intervention on body weight: Methods

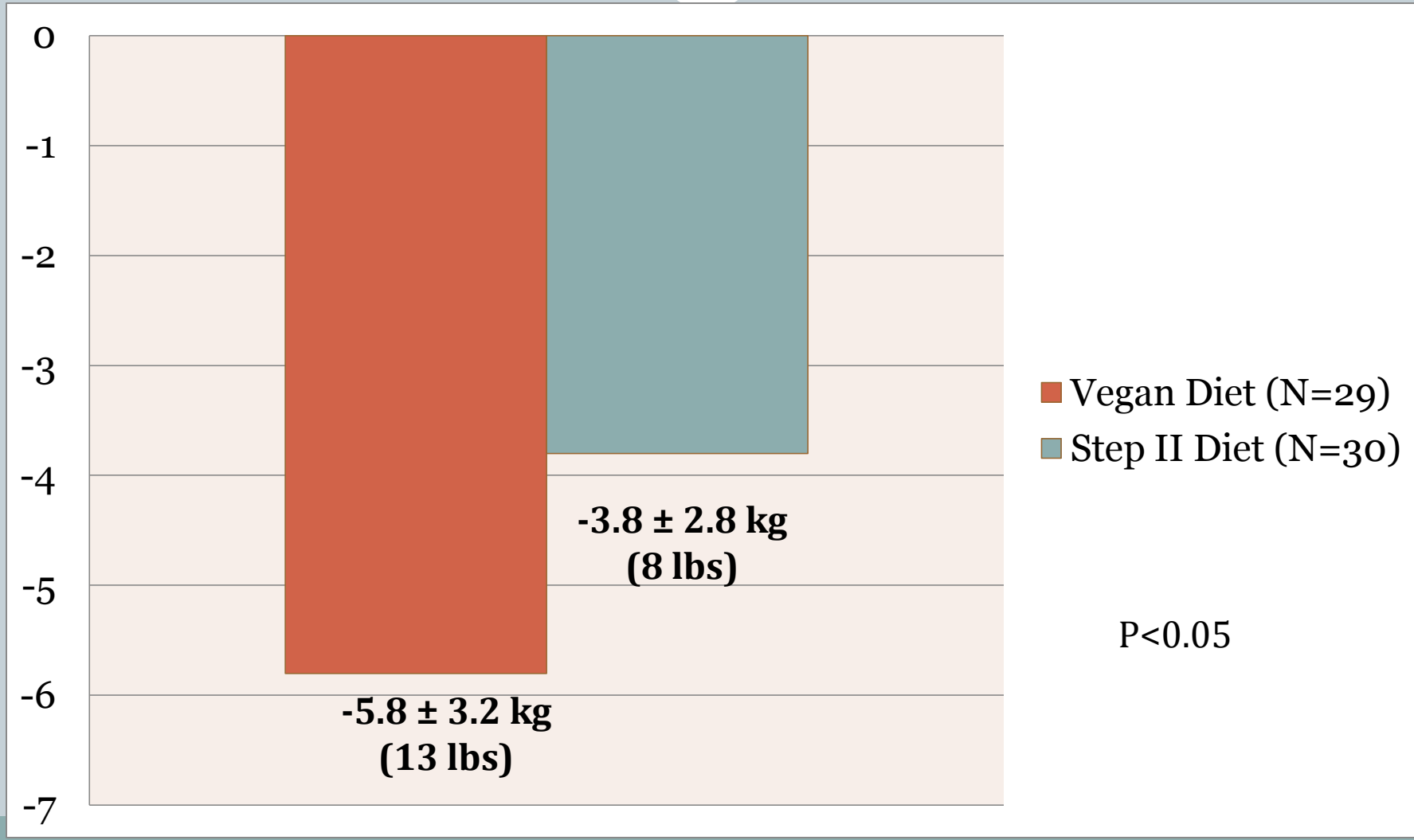
- 64 overweight (BMI 26-44 kg/m^2), postmenopausal women
- Randomly assigned to a low-fat vegan or control diet
- Exercise levels held constant
- 14-week study
- Weekly meetings included:
  - cooking demonstrations
  - meal planning techniques
  - tips for eating out
  - nutrition information

Barnard ND., et. al. *Am J Med*. 2005;118(9):991-7.

Diets

- Low-Fat, Vegan Diet
  - ~10% fat, 15% protein, 75% carbohydrates
- Control Diet (NCEP Step II)
  - Meat ≤6 oz/d
  - Fat ≤60 g/d
  - <30% fat, ~15% protein, >55% from carbohydrates

Results: Weight changes at 14 weeks

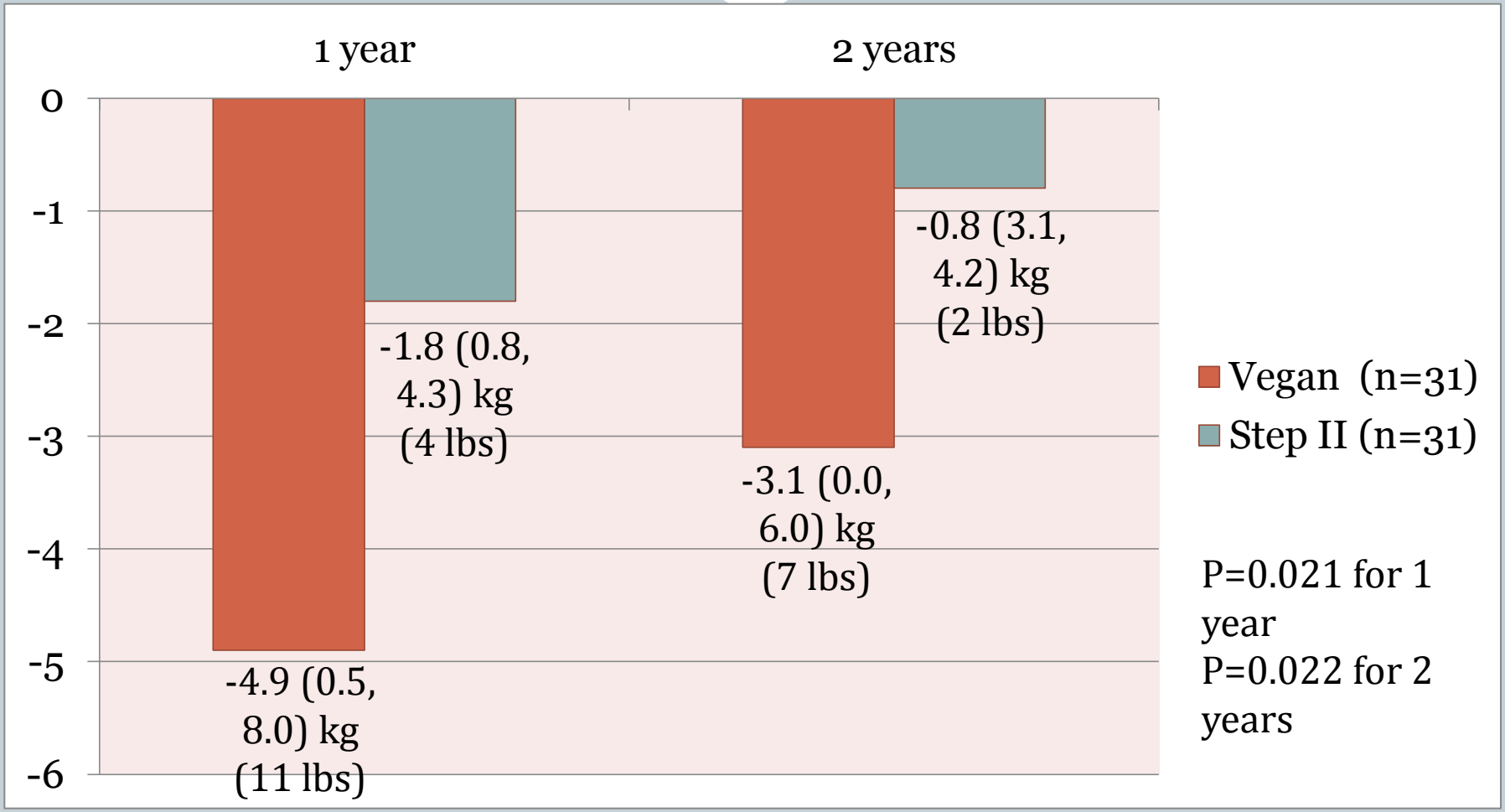


Does adoption of a plant-based diet assist with weight loss maintenance?

- Objective: To assess the effect of a low-fat, vegan diet compared with the Step II diet on weight loss maintenance.
- Weight measured at 1 and 2 years.

Turner-McGrievy GM., et. al. *Obesity*. 2007 Sep;15(9):2276-81.

Results: Weight loss at 1 and 2 years



Weight loss is reported as median (interquartile range) and is the difference from baseline weight at years 1 and 2.

Turner-McGrievy GM., et. al. *Obesity*. 2007 Sep;15(9):2276-81.

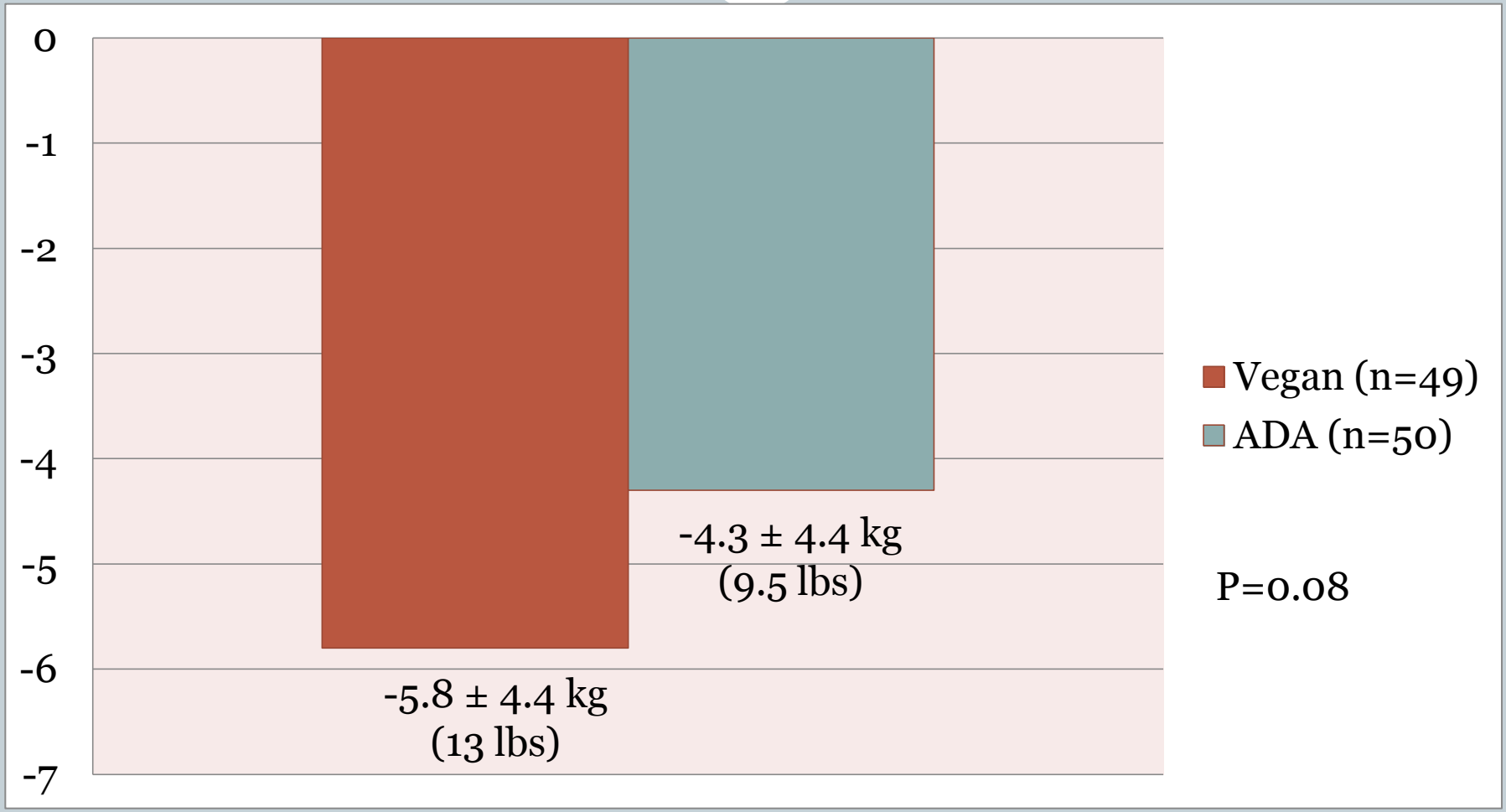
Is a plant-based diet effective as a dietary intervention for type 2 diabetes?

- Improvements in:
  - weight
  - insulin resistance
  - glucose tolerance

Plant-Based Dietary Intervention in Type 2 Diabetes

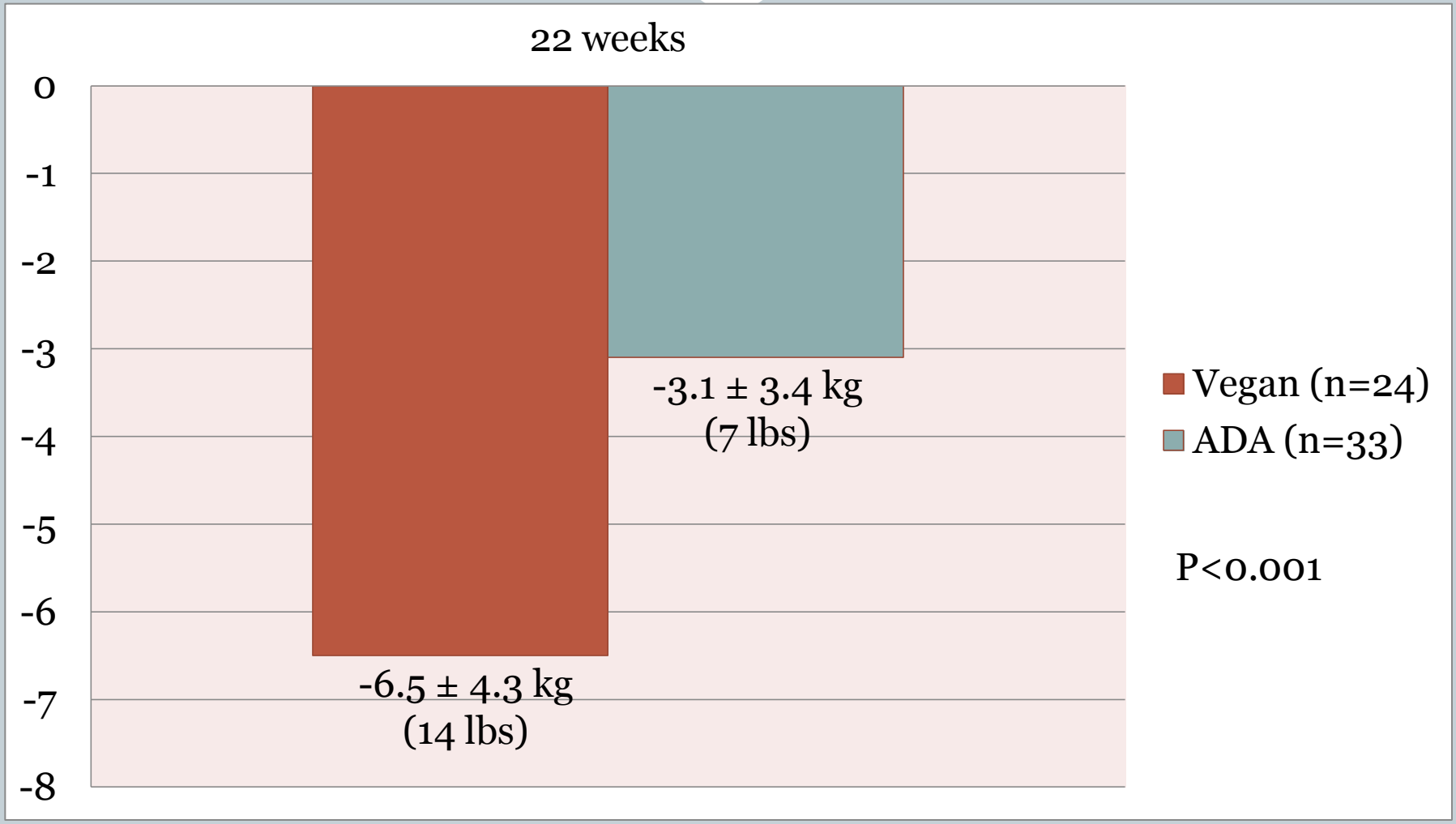
- NIDDK
- Randomized clinical trial
  - Vegan, low-fat, low-GI diet (n = 49)
  - Diet based on ADA guidelines (n = 50)
- 22-week study with 1-year follow-up
- Primary outcome: A1c
- Secondary outcomes: weight, lipids, urinary albumin, dietary intake
- Adult (18 years and older) participants with type 2 DM and a HgbA1c of 6.5-10.5%

Weight loss at 22 weeks (n=49 vegan, 50 ADA)



Barnard ND., et. al. *Diabetes Care*. 2006;29(8):1777-83.

Weight loss at 22 weeks among participants whose diabetes medications remained unchanged



Barnard ND., et. al. *Diabetes Care*. 2006;29(8):1777-83.

Differing dietary approaches to weight loss

- Disease prevention: How do dietary approaches differ in the prevention of chronic disease?
- Adherence: Can people maintain these diets over the long term?
- Acceptability: Do people enjoy following these dietary approaches?

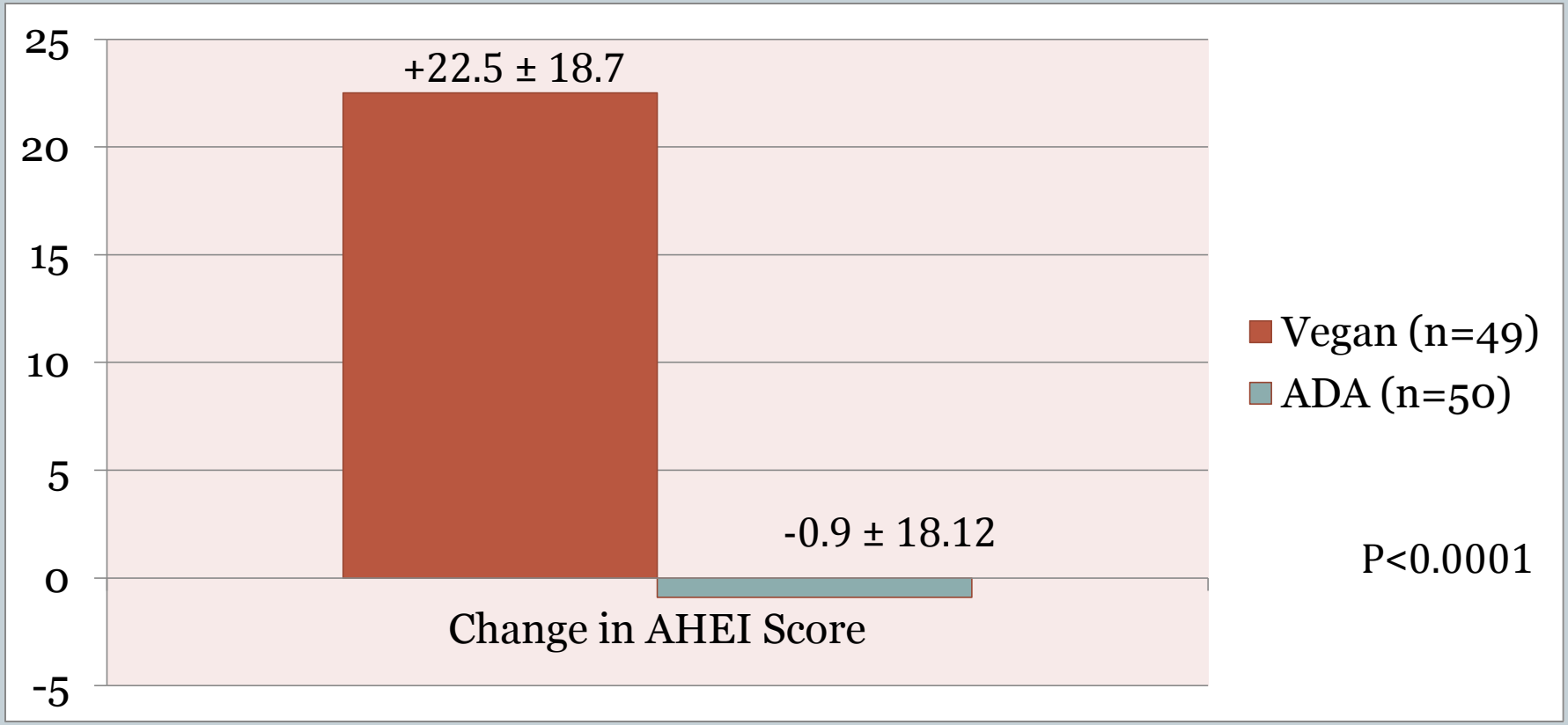
Dietary Quality as Measure for Chronic Disease Prevention

- Alternate Healthy Eating Index (AHEI): predictor of risk of cardiovascular disease and other major chronic diseases.
- AHEI score food categories:
  - vegetables (servings/day)
  - fruit (servings/day)
  - nuts and soy protein (servings/day)
  - ratio of white to red meat (grams)
  - cereal fiber (grams/day)
  - trans fat (% of energy)
  - ratio of polyunsaturated to saturated fatty acids (grams)

Are there differences in diet quality among therapeutic diets for type 2 diabetes?

- Randomized Controlled Trials allow for examination of changes in:
  - Nutrient intake
  - Nutrient adequacy

Dietary Quality (AHEI index)



AHEI score was modestly, negatively correlated with changes in weight (r = -0.27, *P*<0.01).

Turner-McGrievy GM., et. al. *J Am Diet Assoc.* 2008;108(10):1636-45.

Dietary Adherence & Acceptability

- Dietary Adherence
  - Weight loss trial
    - 1 and 2 years: 61% vegan; 55% Step II
  - DM trial
    - 22 weeks: 67% vegan; 44% ADA
    - 74 weeks: 51% vegan; 58% ADA
- Hunger
- Acceptability
    - Food preparation

Obesity. 2007 Sep;15(9):2276-81.
J Am Diet Assoc. 2009 ;109(2):263-72.
J Cardiopulm Rehabil. 2004 Jul;24(4):229-35.

Use of plant-based approach in the public health setting

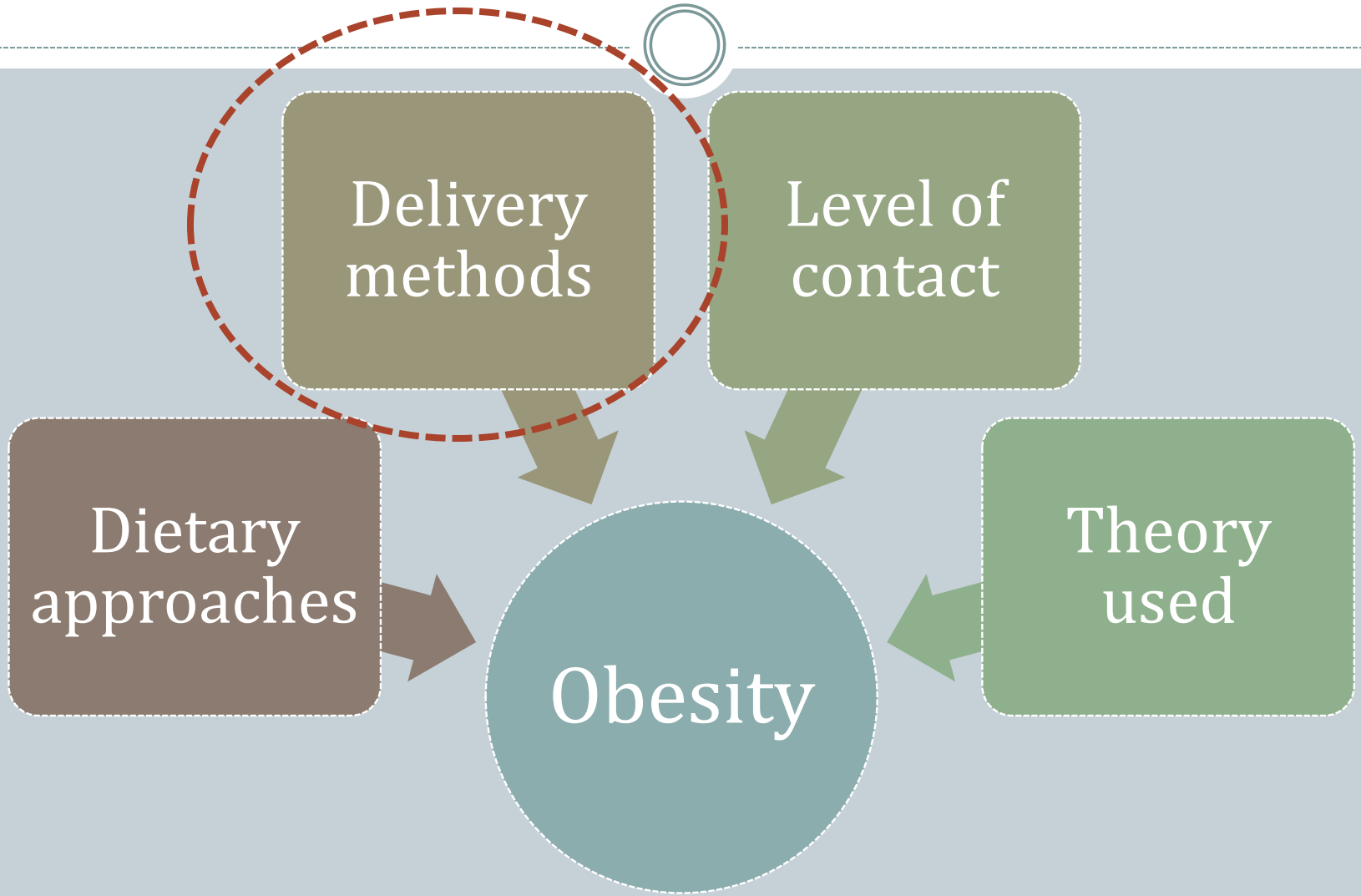
- Appeal of plant-based diets for weight loss
  - Low energy density
  - No need to count kcals, fat grams, or carbohydrate grams, or to measure portion sizes
  - No need for individual meals plans
- Improved diet quality as measured by AHEI

Dietary Quality of Popular Weight Loss Plans (out of 70)

The Ornish plan was significantly different from the Atkins/100-g carbohydrate (P=0.007), Atkins/45-g carbohydrate (P=0.0004), South Beach/Phase 3 (P=0.005), and Weight Watchers' high-protein plans (P=0.02).

Ma Y. *J Am Diet Assoc*. 2007 Oct;107(10):1786-91.

Aspects of weight loss intervention research

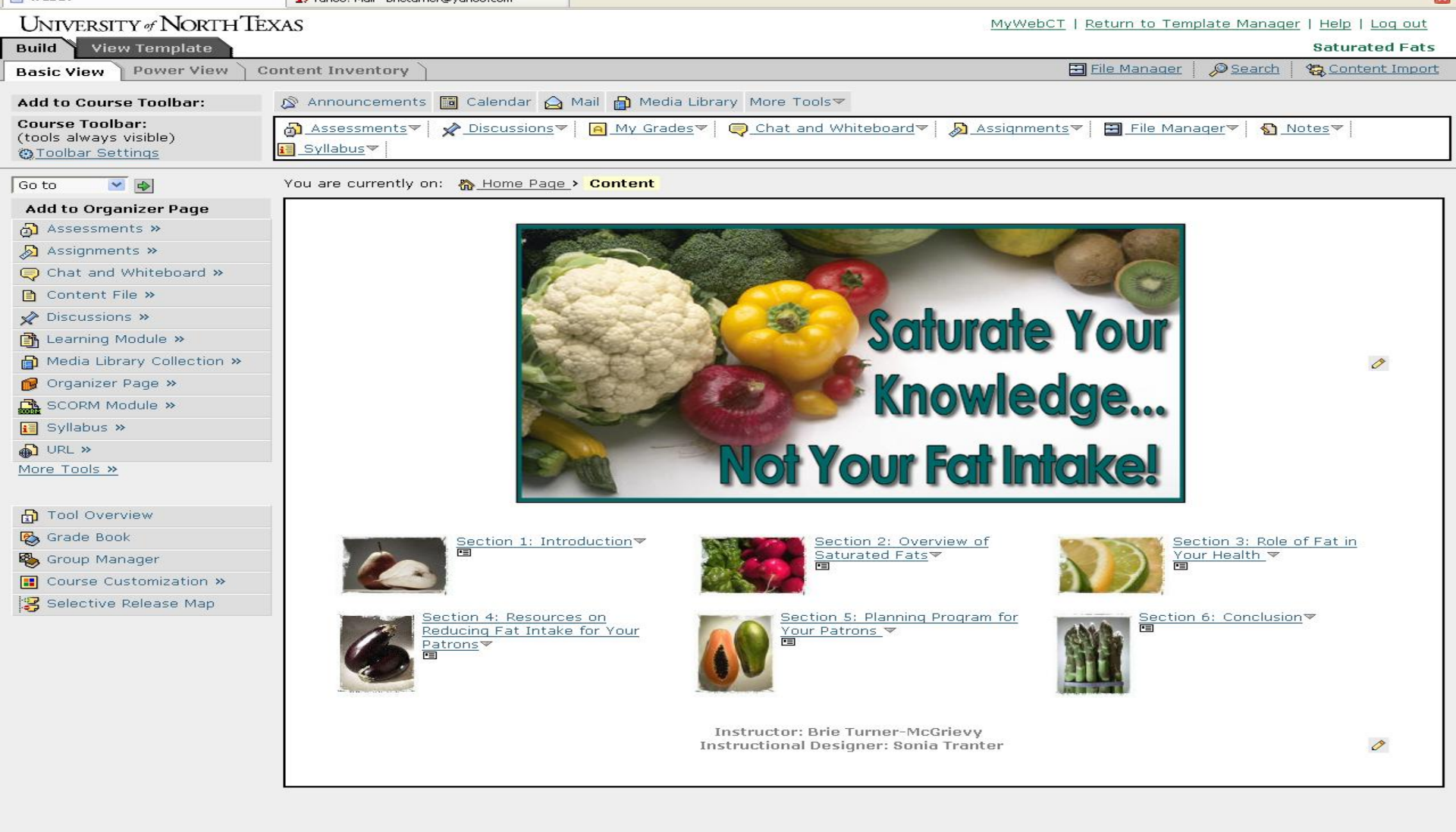


Emerging technologies for weight loss

Nutrition information to the desktop

- Funding: Johns Hopkins University Health Scholars Program
- Pilot study: An online lesson on decreasing saturated fat intake offered to librarians and library paraprofessionals through *LE@D: Library Education @ Desktop* (www.leadonline.info).
- Why Libraries?
  - Research shows that patrons are requesting health information at libraries but librarians are not well-equipped to help them.
  - Next steps: To provide a Web-based "train-the-trainer" course for public librarians on health issues.

Wood FB, et. al. *Bull Med Libr Assoc*. 2000;88: 314–22.

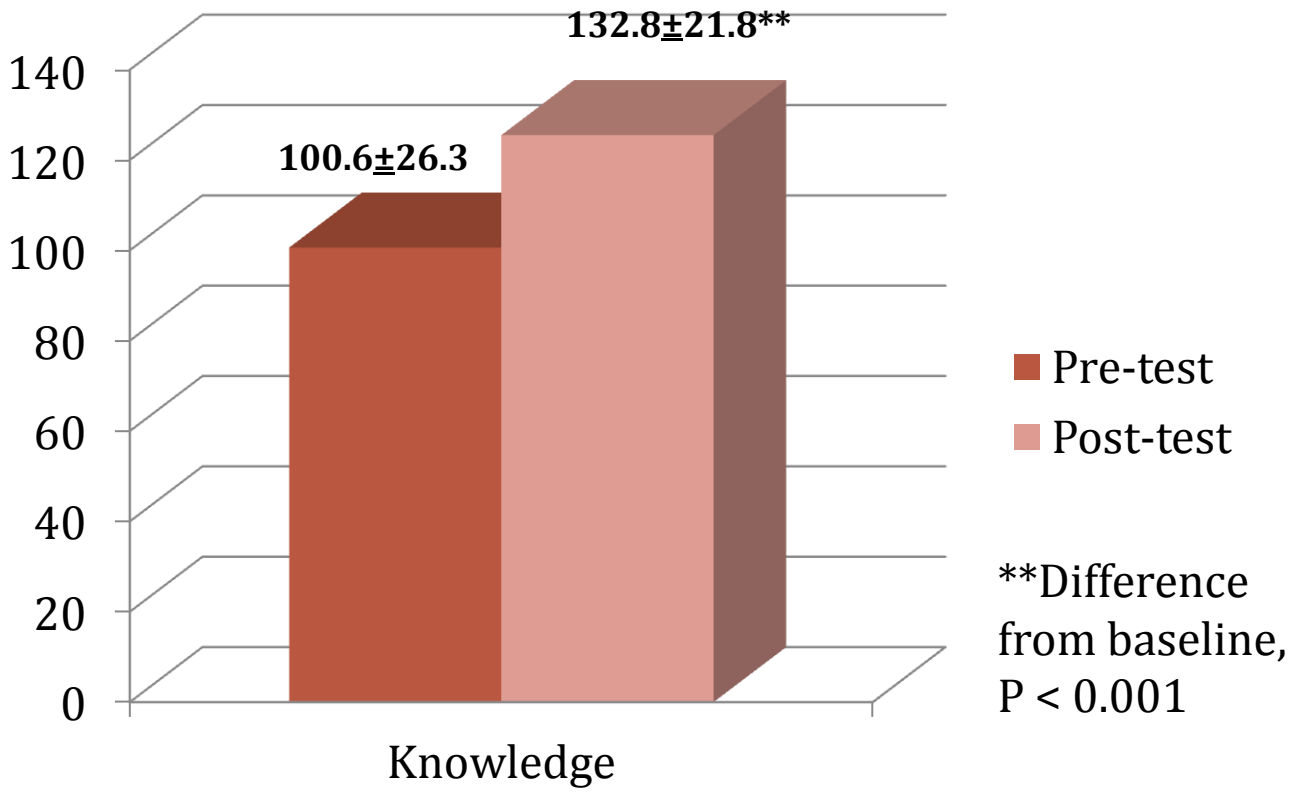


- Goal of course: Help librarians know how to find health-related materials for patrons

Study Methods: Evaluation

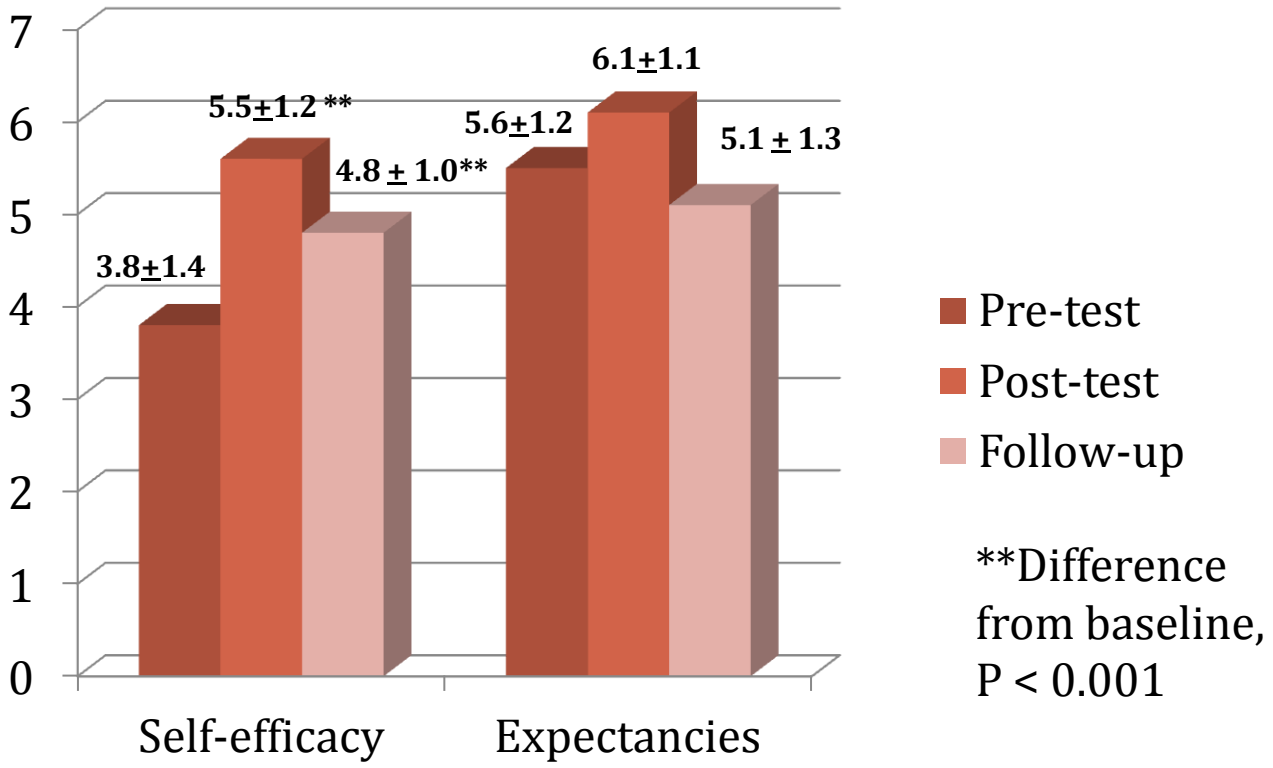
- N=100 consented and completed course
- Completed a survey 6 months after finishing the lesson.
  - Attitudinal changes
  - Use of the information in the lesson

Knowledge Score: Pre- and Post-Test (out of 160)



Turner-McGrievy GM. *J Nutr Educ Behav*. 2009 41(3):188-93.

Self-efficacy and Expectancies (1 to 7 scale) at pre-test, post-test, and 6-month follow-up



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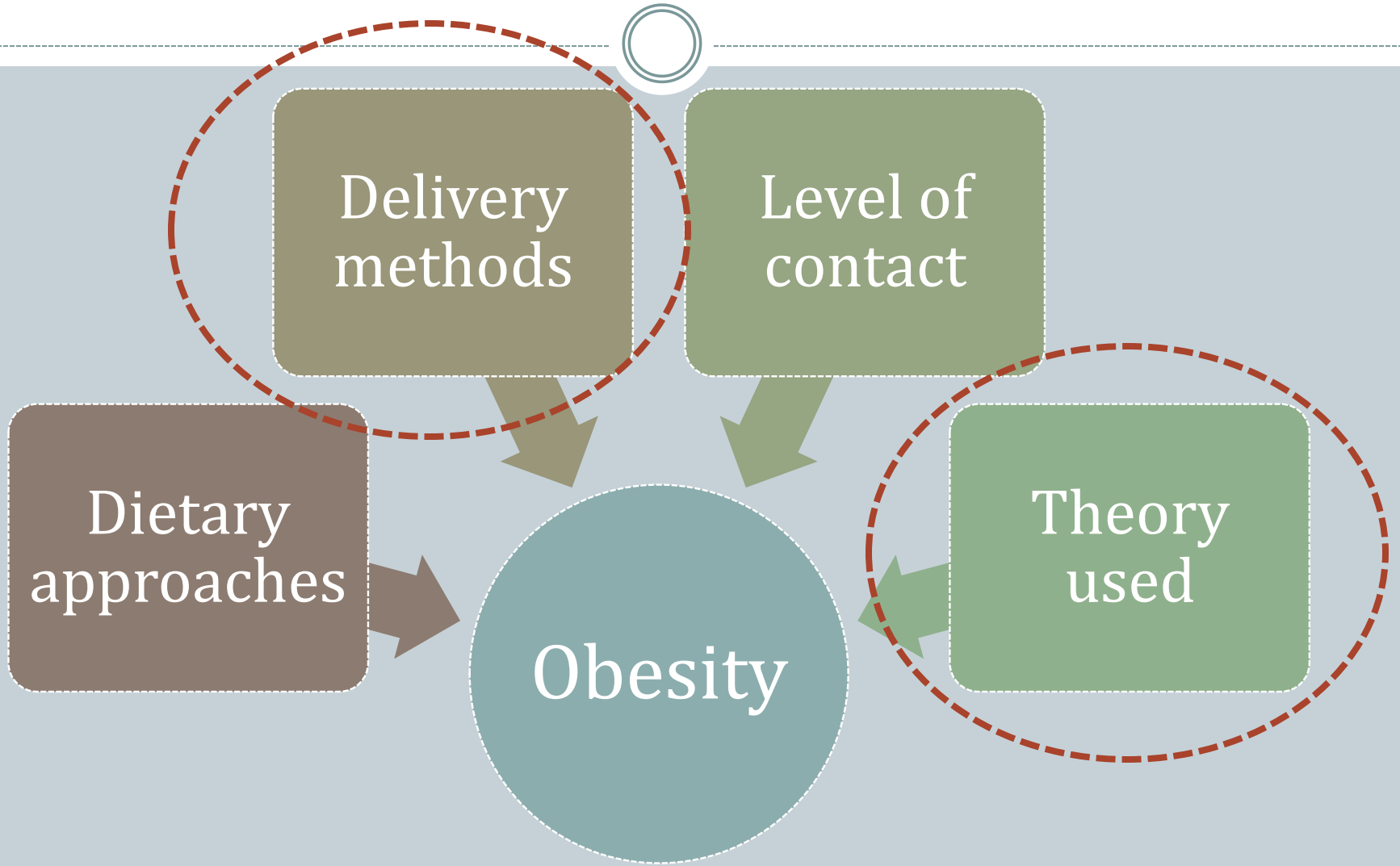
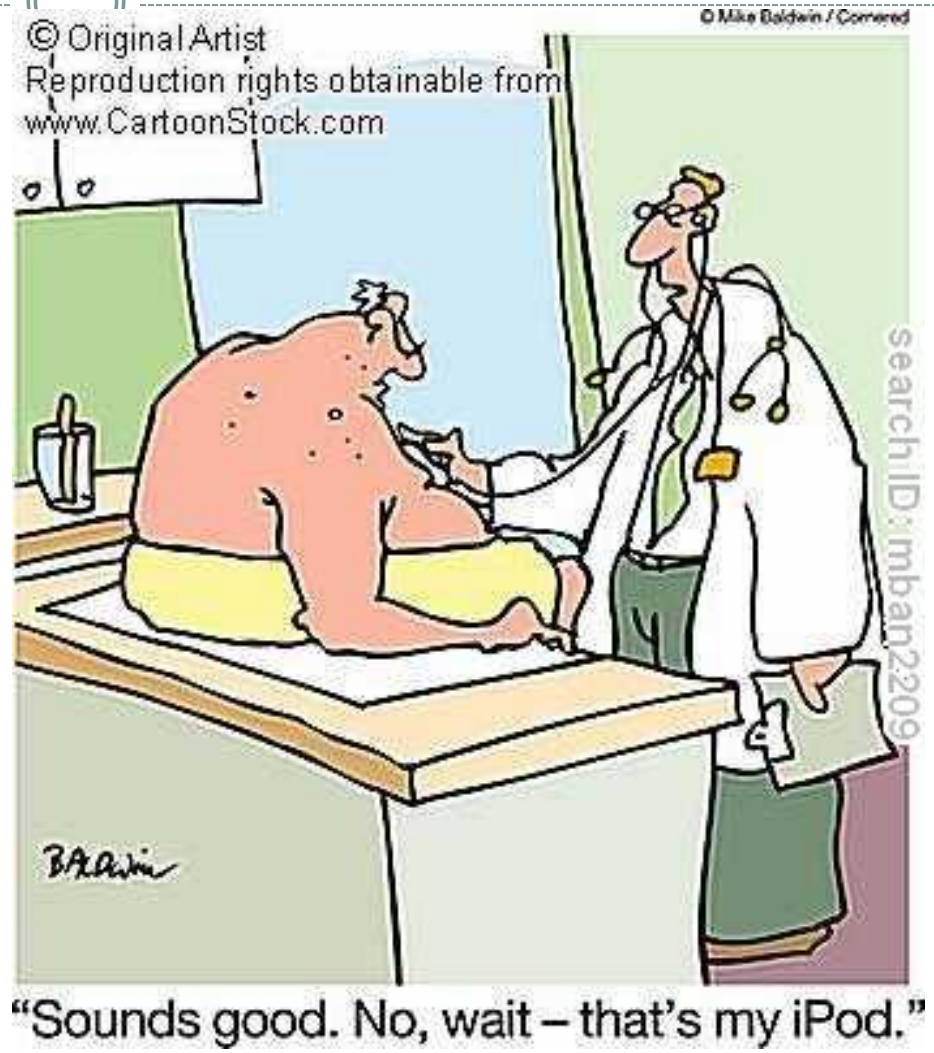
Aspects of weight loss intervention research



Mobile technologies

What is podcasting?

- Comes from the terms “broadcast” and “iPod.”
- Podcasts are audio files that may be downloaded and listened to on a computer or any portable audio player (MP3 player).



Pounds Off Digitally (POD) Study

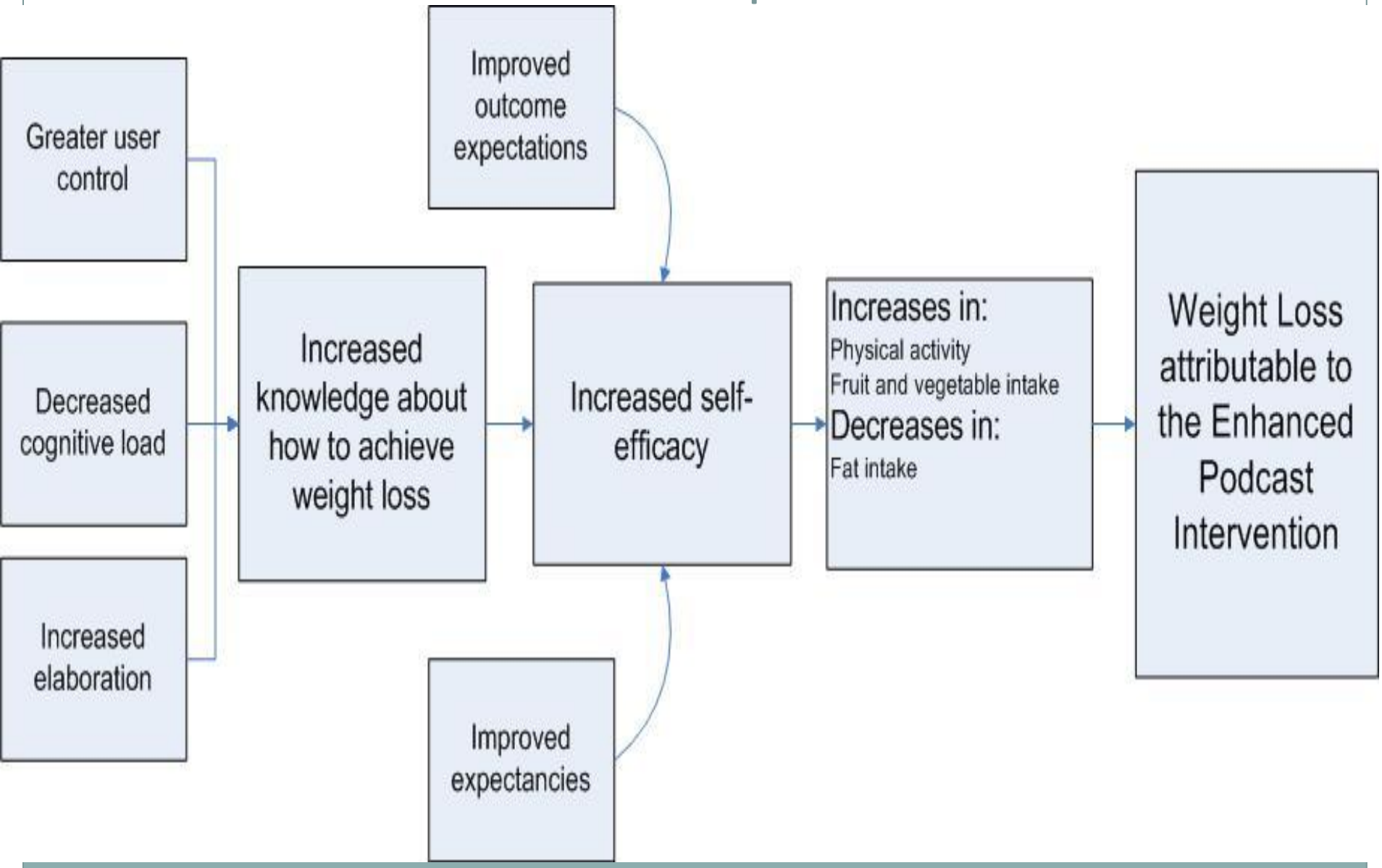
- To determine whether podcasting weight loss information is an effective way to promote weight loss and improve diet and physical activity through a 12-week intervention with adults comparing an existing weight loss podcast to an enhanced, theory-based podcast.

Theories used in the design of enhanced podcast

- Social Cognitive Theory (SCT)
  - People learn through their own experiences and observations.
- User Control Theory
  - Control over environment leads to more effective learning.
- Cognitive Load Theory
  - Decreasing cognitive load leads to better learning.
- The Elaboration Likelihood Model (ELM)
  - Greater elaboration leads to greater changes in attitudes and behaviors.

Eveland WPJ, et. al. Comm Res 2001;28:48-78.; Brunken R, et. al. Educ Psych 2003;38:53-61.; Paas F, et. al. Educ Psych 2003;38:63-71.; Bandura A. Health Educ Behav 2004;31:143-64.; Petty RE, et. al. The Elaboration Likelihood Model of persuasion. New York: Academic Press, 1986.

Methods: Conceptual Model



Methods: Intervention components and how each targets the theory constructs

SCT Construct	Intervention Component
Expectancies	The *Nutrition and Exercise Information* of each Podcast emphasized the importance of achieving a healthy weight to increase the value participants place on weight loss.
Expectations	The *Audio Diary* allowed for a first-hand experience of weight loss and informed participants about what to expect from trying to lose weight.
Self-efficacy	The end of the Podcast included a *Goal to Achieve*. Participants were encouraged to track their weight, calories, and exercise. The aim of goal achievement was to increase confidence.
Behavioral Capability	Knowledge about how to lose weight, exercise, make dietary changes, etc. was presented during the *Nutrition and Exercise Information* and *Soap Opera* sections of the podcast.

Methods: Groups

- Randomly assigned to:
  - Enhanced, theory-based podcast:
    - introduction
    - audio diary
    - nutrition and exercise information
    - continuing soap opera
    - goals
  - Control podcast: “Best available” weight loss podcast
    - Focused on cognitive restructuring: "Think Fit. Be Fit."
    - Example topics included:
      - Goal setting tips
      - Types of exercise

Methods: Participant criteria

- Overweight men and women (body mass index, 25–40 kg/m^2)
- 12-week intervention, 24 episodes
- Exclusion criteria
  - unstable medical status, history of an eating disorder, pregnancy, alcohol or drug abuse, tobacco use, mental illness, diabetes mellitus, or an uncontrolled thyroid condition
- Inclusion criteria:
  - own digital music player (MP3 player) and had access to a body weight scale

Methods: Measures

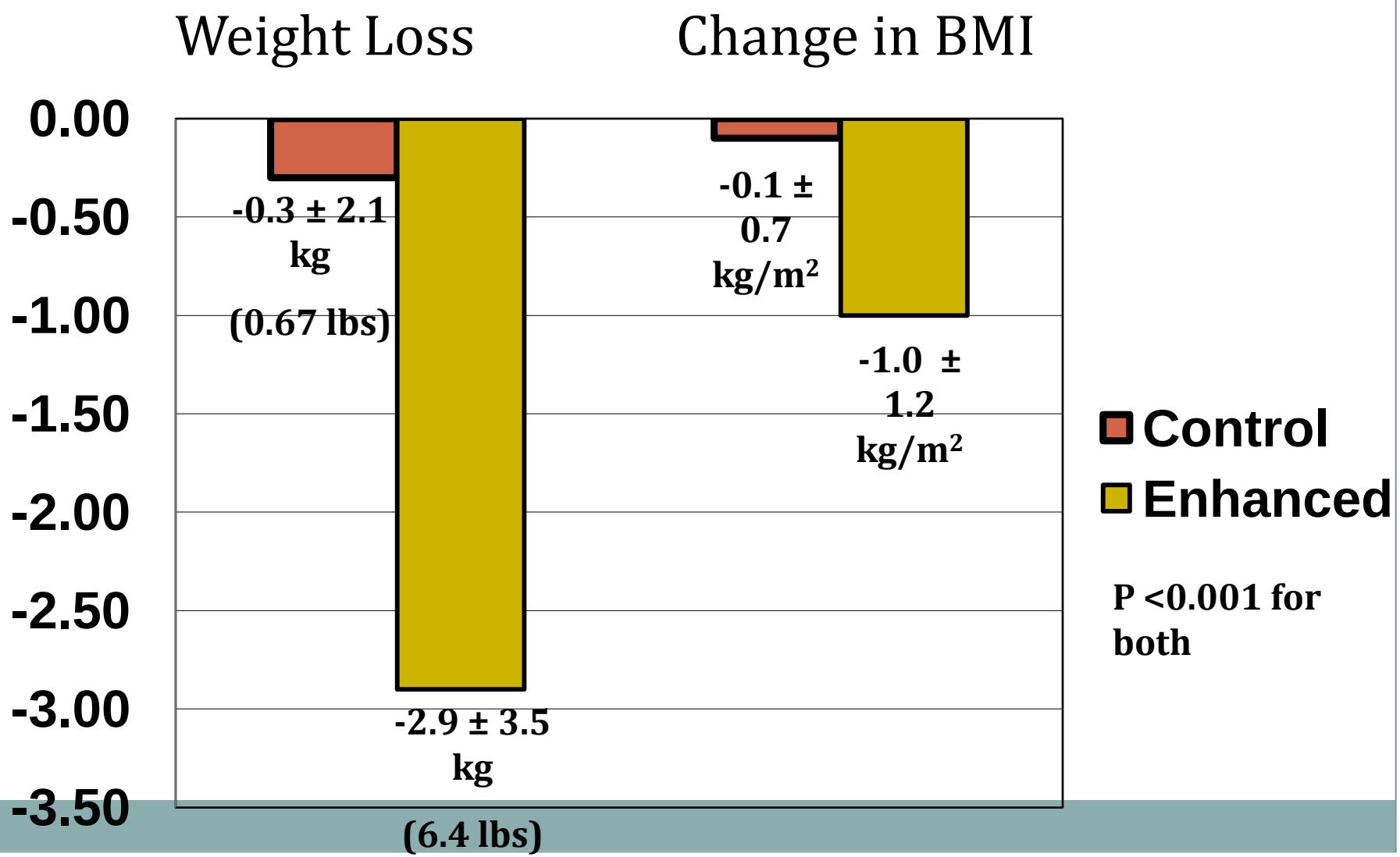
- Demographics
- Height (stadiometer)
- Weight (digital scale accurate to 0.1 kg)
- Fruit, vegetable, and high fat food intake (PrimeScreen Questionnaire)
- Physical activity (short IPAQ)
- Information Processing
  - Elaboration
  - User control
  - Cognitive load

Demographics

	Control Group	Enhanced Group
n	37	41
Age (years) (mean ± SD)	39.6 (± 12.2)	37.7 (± 11.8)
Sex [*N* (%)]		
Male	7 (19)	13 (32)
Female	29 (81)	28 (68)
Race, ethnicity [*N* (%)]		
Black	6 (17)	5 (13)
White	28 (78)	35 (85)
Other	2 (5)	1 (2)

*No significant differences between groups at baseline

Results: Changes in weight and BMI



Results: PrimeScreen Food Categories

	Control group (n = 36)	Enhanced group (n = 41)	P-value
Vegetables consumption category			
Baseline	2.4 ± 0.6	2.3 ± 0.7	
12-weeks	2.6 ± 0.7	2.6 ± 0.7	
Difference	**0.01 ± 0.4**	**0.4 ± 0.7**	**<0.05**
Fruit consumption category			
Baseline	2.9 ± 0.8	2.5 ± 1.0	
12-weeks	2.7 ± 0.6	2.7 ± 0.7	
Difference	**-0.2 ± 0.7**	**0.2 ± 0.9**	**<0.05**
High fat foods consumption category			
Baseline	2.1 ± 0.5	2.1 ± 0.5	
12-weeks	1.9 ± 0.5	1.8 ± 0.5	
Difference	**-0.2 ± 0.4**	**-0.3 ± 0.4**	**0.14**

Results: IPAQ Physical Activity

	Control group (n = 36)	Enhanced group (n = 41)	P-value
Vigorous activity (days/week)			
Baseline	1.8 ± 1.8	1.2 ± 1.4	
12-weeks	1.4 ± 1.6	2.1 ± 1.9	
Difference	**-0.4 ± 1.4**	**0.8 ± 0.9**	**<0.01**
Moderate activity (days/week)			
Difference	0.3 ± 2.2	0.9 ± 2.0	0.22
Walking (days/week)			
Difference	0.2 ± 2.2	0.7 ± 2.0	0.29
Sitting (hours spent/day)			
Difference	-0.3 ± 8.7	-0.8 ± 4.8	0.73

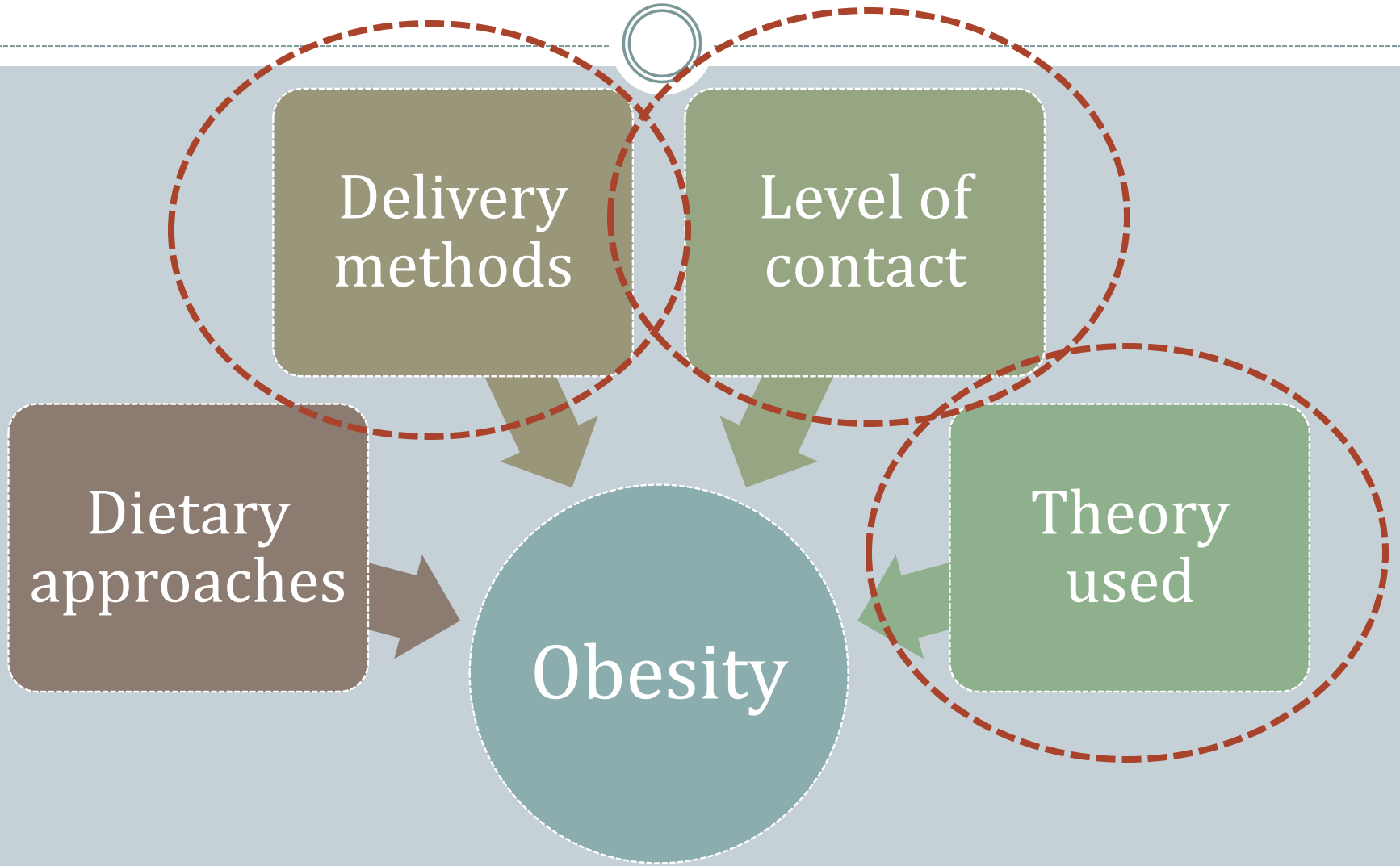
Results: Elaboration, User Control, Cognitive Load, and Intervention Perception at 12-weeks

	Control group (n = 37)	Enhanced group (n = 41)	P-value
Elaboration score (possible range 9-63)	24.7 ± 15.4	41.3 ± 12.3	**<0.001**
User Control score (possible score range 10-70)	40.6 ± 16.0	53.6 ± 12.9	**<0.001**
Cognitive Load score (possible score range 2-14)	6.5 ± 4.1	10.6 ± 3.1	**<0.001**
Intervention Perception score (possible score range 3-21)	11.2 ± 7.1	17.4 ± 5.1	**<0.001**
Number of podcasts participants reported they listened to during the study (out of 24)	16.6 ± 7.5	17.5 ± 8.1	0.67

Strengths & Limitations

- Strengths
  - Randomized design and ITT
  - Applicable outside the research setting
    - minimal face-to-face intervention
    - prepared all their own meals
    - found their own ways to increase physical activity
  - Low cost and easy to disseminate
- Limitations
  - Isolating variables of interest
  - Short-term
  - Modest weight loss
  - No group support

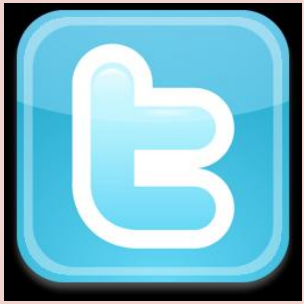
Aspects of weight loss intervention research



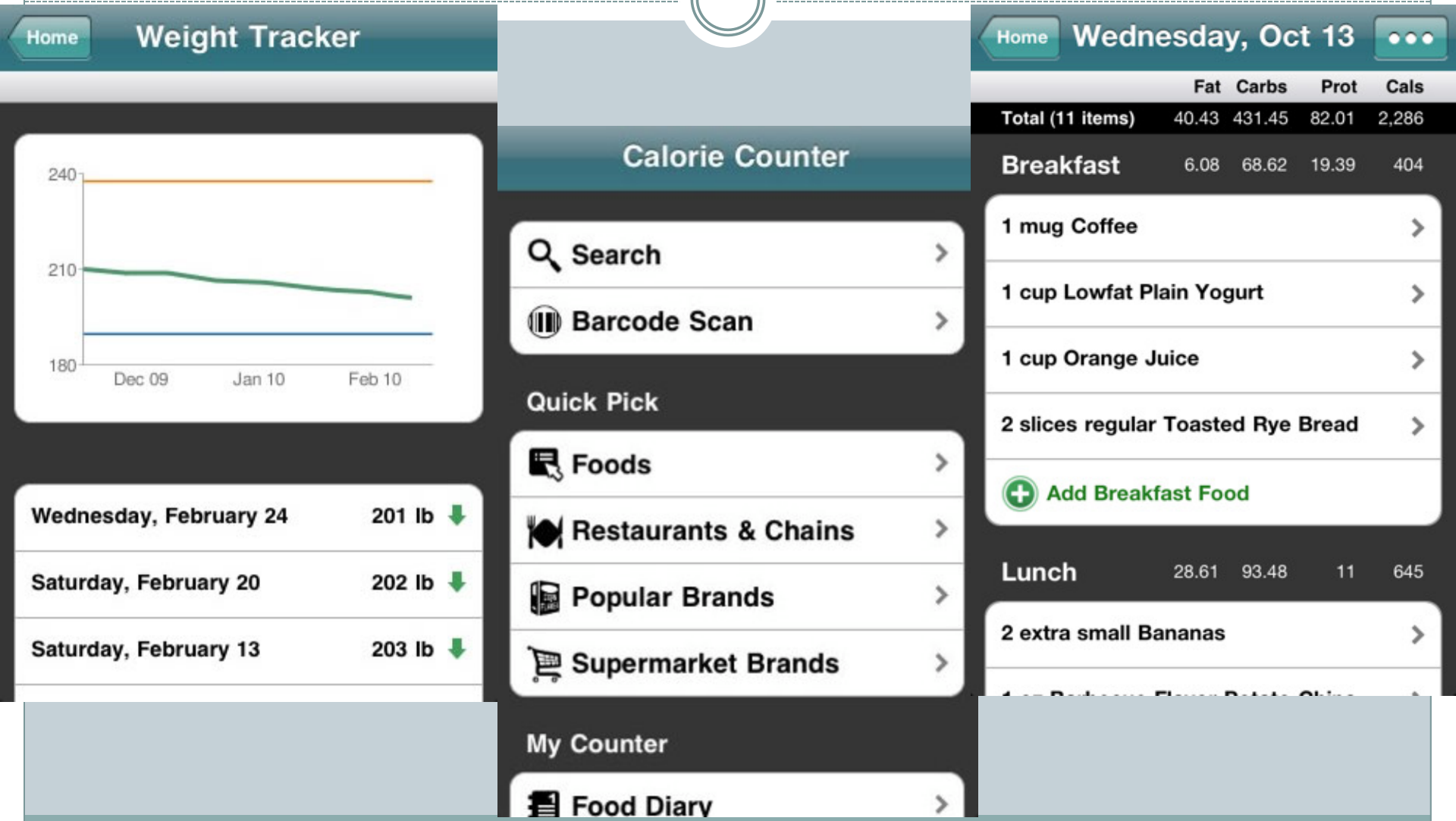
POD Study 2

- Podcast only vs. Podcast + enhanced mobile media intervention
- 6 month weight loss trial
- All participants have smart phones

Groups

Podcast only	Podcast + mobile
Twice weekly podcasts (~20 minutes) for 0-3 months	Twice weekly podcasts (~20 minutes) for 0-3 months
Twice weekly mini-podcasts (5-10 minutes each) for 3-6 months	Twice weekly mini-podcasts (5-10 minutes each) for 3-6 months
	Monitoring of diet and physical activity using app on mobile device
	Group and moderator support via Twitter
	 +  + 

Mobile diet and physical activity app

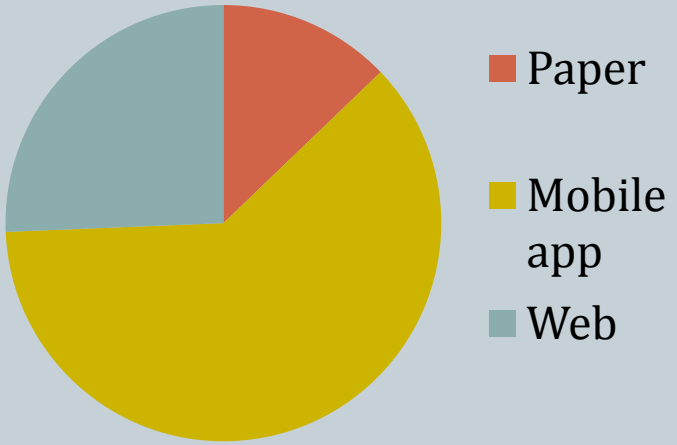


Baseline Demographics of POD Study 2

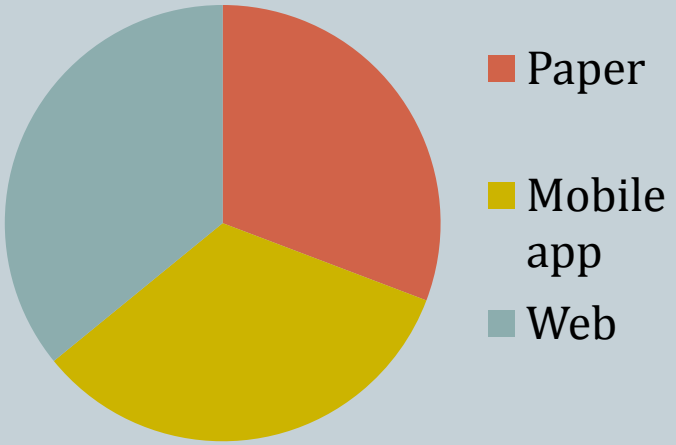
	Podcast only	Podcast + Mobile Group
n	49	47
Age (years) (mean ± SD)	43.6 (± 11.7)	42.6 (± 10.7)
Sex [*N* (%)]		
Male	13 (27)	11 (23)
Female	36 (73)	6 (77)
Race, ethnicity [*N* (%)]		
Black	10 (20)	9 (19)
White	38 (78)	35 (75)
Other	1 (2)	3 (6)

No significant difference in weight loss between groups but differences in type of self-monitoring used

Mobile group



Podcast group



Mobile participants were 3.5 times more likely to use an app to monitor diet (P=0.01) than the Podcast group.

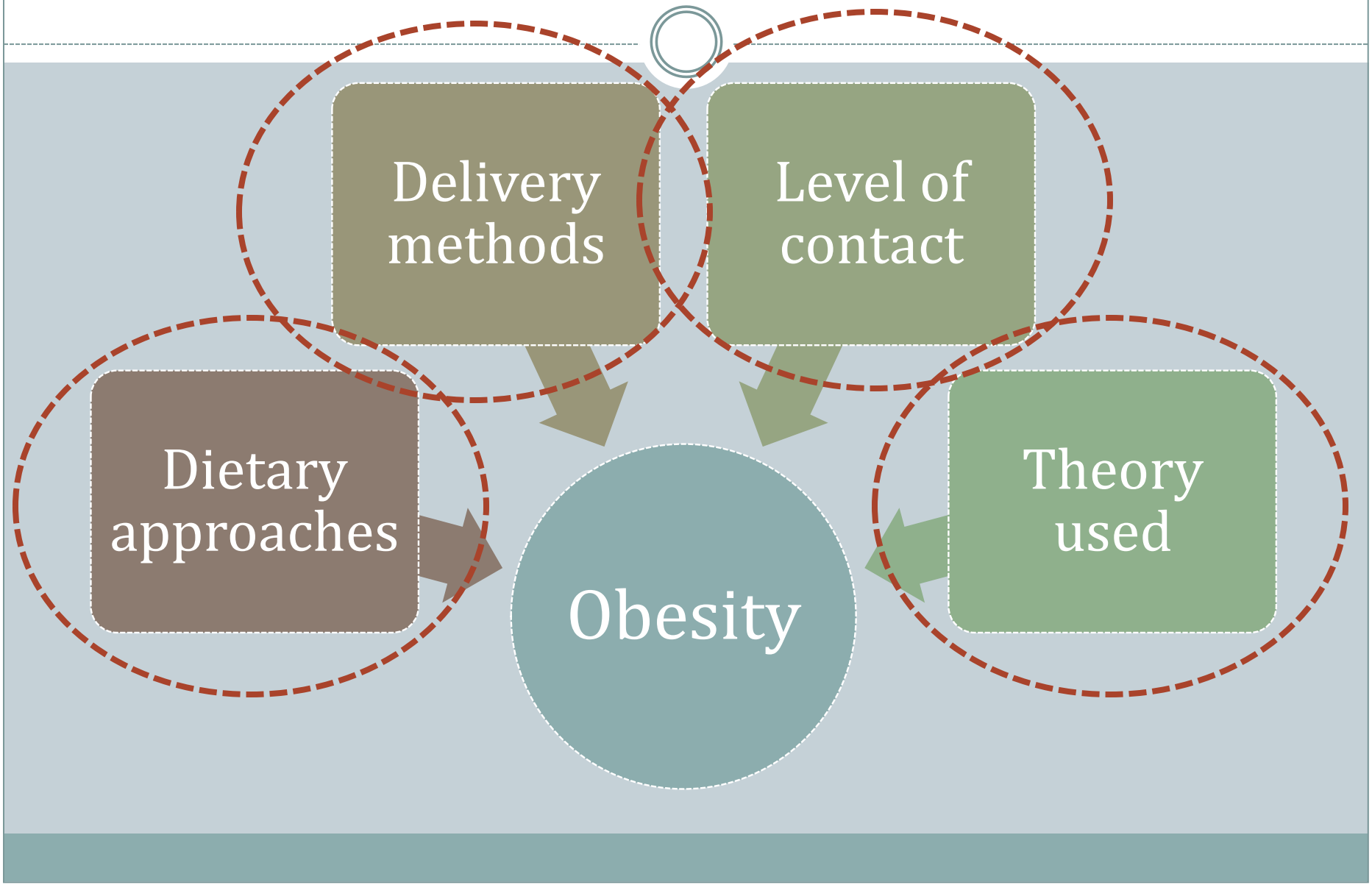
Differences in self-monitoring frequency

Mean days/week reported recording dietary intake	Podcast	Mobile	P value
0-3 months	2.4±2.0	2.9±2.1	0.26
3-6 months	1.3±1.7	1.7±2.0	0.39

Future Research at USC

- Upcoming studies
- Study ideas in the works

Combining all aspects of weight loss intervention research



Healthy Eating for Reproductive Health (HER Health)

- The rise of obesity has corresponded with a rise in women with polycystic ovarian syndrome (PCOS).
- As many as 18% of women of reproductive age have PCOS, which is characterized by:
  - irregular menstrual cycles or complete annovulation
  - elevated testosterone levels
  - infertility
- Women with PCOS are at a higher risk of developing
  - cardiovascular disease
  - insulin resistance
  - metabolic syndrome
  - type 2 diabetes

HER Health Rationale

- Vegan diets are associated with higher serum sex-hormone binding globulin (SHBG) (which is low in women with PCOS).
  - Low SHBG leads to higher levels of testosterone and infertility
- Improvements in weight and insulin resistance.
- No studies to date that have focused on improving fertility among women with PCOS through a lifestyle intervention.

Research Questions

- Is a low-fat, low-GI, vegan dietary approach an effective way to help women with PCOS achieve:
  - a clinically meaningful weight loss (5% or greater)
  - change in waist circumference
  - regulation of ovulatory function
  - improved fertility outcomes
  - improvement of measures of quality of life
- As compared to a standard calorie-controlled dietary approach

Methods

- Collaborators: Dr. Debbie Billings, HPEB; Dr. Judith Burgis, Department of OBGYN
- 6-month pilot test in 50 overweight women with PCOS comparing a low-fat, low-GI vegan diet approach to a standard, low-fat, calorie-controlled approach

HER Health Goal

- Collect pilot data in order to submit for NIH funding
- Currently working out format (group sessions vs. individual vs. remotely delivered)
- Collaborators:
  - Medical outcomes/women's health
  - Environmental/dietary contaminants (mercury)
  - Psychosocial issues of dealing with infertility treatment and effects of dietary intervention

MoDPoD: Mobile Diets for Pounds off Digitally

- R21: NCI Exploratory Grants for Behavioral Research in Cancer Control
- Conduct a 6-month pilot test in 50 overweight adults comparing:
  - standard, theory-based podcast (TBP) approach
  - TBP + tailored content (video podcasts and e-mails) + written lessons each week (TBP+enhanced).

Future studies

- mHealth Tools to Promote Effective Patient–Provider Communication, Adherence to Treatment and Self Management of Chronic Diseases In Underserved Populations (NIH R03, R21, R01)
  - The purpose of this initiative issued by the National Institute of Nursing Research (NINR) and the Office of Dietary Supplements (ODS) is to stimulate research ***utilizing Mobile Health (mHealth) tools aimed at the improvement of effective patient–provider communication, adherence to treatment and self-management of chronic diseases*** in underserved populations.

Future Studies

- NIH support
- Connects researchers with:
  - Mobile Operators/Carriers
  - Device and Technology Vendors
  - Content and Application Developers
  - Policymakers and Government Representatives from Around the World
  - Healthcare Professionals
  - Clinical Technologists
  - Insurance Companies and Payers
  - Pharmaceutical Companies
  - Financial Sector
  - NGOs and International Organizations
  - Not-for-profit Organizations

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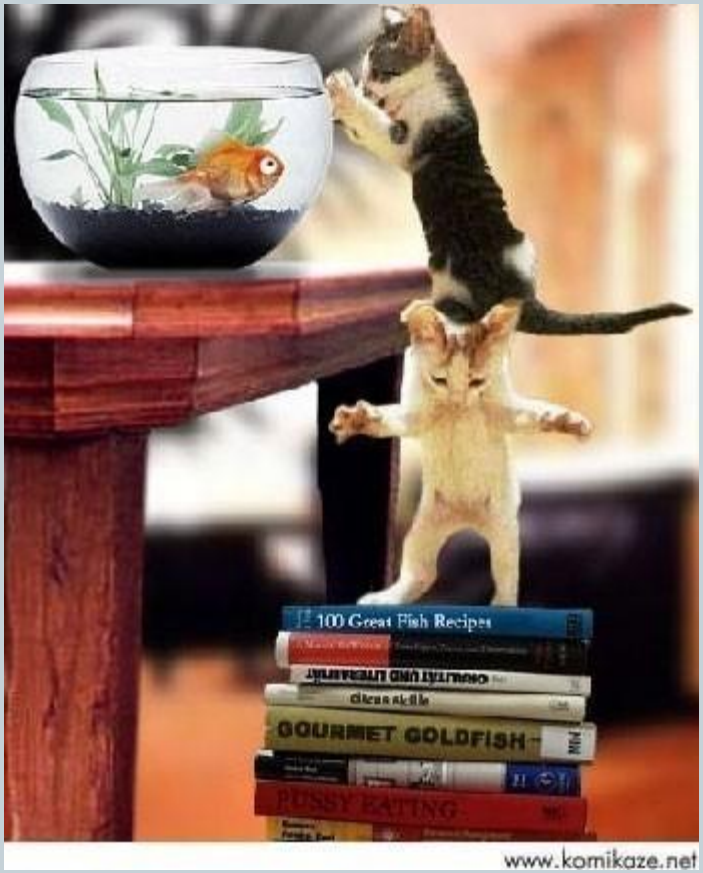
Future studies

- In September 2011, HHS announced the Text4Health task force recommendations.
- The Task Force was charged with identifying ongoing initiatives and proposals for feasible new projects which would deliver health information and resources to users' fingertips via their mobile phones.
  - Recommendation 1: Facilitating Health Text Messaging Development
  - Recommendation 2: Research and Evaluation

Future studies

- If any of this sounds interesting, lets work together!



Questions?

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