Body Mass Index (BMI) and Obesity Prevalence Among Substance Abuse Participants from NIDA's Clinical Trials Network (CTN)

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Introduction

- Addictive drugs and food both activate the same reward circuit in the brain[1,2]
  - For example, stimulant addicts and obese individuals have low DRD2 activity on PET scans[3-5]
- Drug development for both substance abuse and obesity has focused on reinforcing properties-related neurotransmitters, neuromodulators and their receptors (e.g. dopamine, opioid, serotonin, GABA and cannabinoid[6])
- However, it is unknown how a specific addictive drug interacts with an individual's diet and body weight
- In contrast, it is well known cigarette smoking contributes to weight loss possibly through activation of the POMC neuron in arcuate nucleus, thus activating melanocortin (MC 4) receptors in hypothalamus to inhibit appetite[7,8]
- The unclear relationship between substance use and body weight motivated us to investigate BMI levels and prevalence of obesity in substance users and compare to the general US population.

Objectives

1. Characterize BMI and prevalence of obesity in CTN participants
2. Compare BMI and obesity rates with the general US population using the NHANES[9] data
3. Within the CTN, compare mean BMI and the prevalence of obesity between opiate and stimulant users

Study Populations

1. CTN: all available *baseline* data from trials that collected BMI
   - Four trials sampled primary opiate users (N=908) – smoking status not collected for any of these trials
   - Three trials sampled primary stimulant users (N=1109) – smoking status collected for all three studies
   - Total N = 2,017
2. NHANES: all available data from cycles that match recruitment periods for above 7 CTN studies
   - Three sets of two-year cycles match the CTN opiate trials (2001-2, 2003-4, 2005-6) (N=7769)
   - One two-year cycle matches the CTN stimulant titles (2009-2010) (N=3197)
   - Total N = 10,966

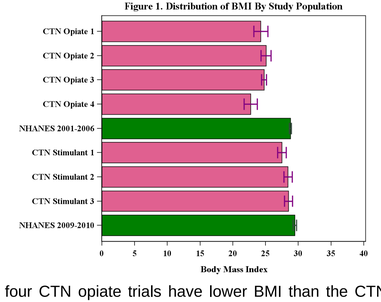
Methods

- BMI was considered using two metrics
  1. Mean BMI
  2. Indicator of obesity (BMI ≥ 30kg/m^2)
- Compare prevalence of obesity between CTN and NHANES populations
  1. Split CTN and NHANES populations into groups based on:
     - Gender
     - Race (non-Hispanic White vs. Black/African American)
     - Age (20-40 years old vs. 40+ years old)
  2. Compute standardized prevalence ratios (SPRs) and corresponding confidence intervals (CIs) using the prevalence of obesity in the NHANES subgroups of age, race and gender (and smoking status when available) to calculate the expected number of obese individuals
- Compare mean BMI between CTN and NHANES population using ANOVA
  - Use ANOVA
  - Adjust for age, race and gender (and smoking status when available)
- Compare mean BMI between opiate and stimulant users within the CTN
  - Use ANOVA
  - Adjust for age, race and gender

Results

Figure 1 characterizes the raw baseline BMI for the CTN and NHANES.

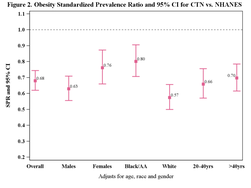
Figure 1. Distribution of BMI By Study Population



- The four CTN opiate trials have lower BMI than the CTN stimulant trials and both NHANES samples.
- The three CTN stimulant trials have similar, but slightly lower, body mass indices to the NHANES populations.

Results

Figure 2. Obesity Standardized Prevalence Ratio and 95% CI for CTN vs. NHANES



The prevalence of obesity in the CTN population is less than that of NHANES regardless of age, race or gender (Figure 2)

Obesity is less prevalent among opiate users than the matched NHANES participants regardless of age, race or gender (Figure 3)

Figure 3. Obesity SPR and 95% CI for CTN Opiate Users vs. Matched NHANES

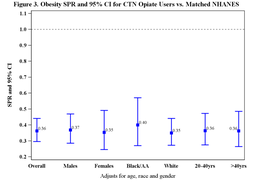
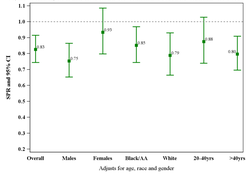
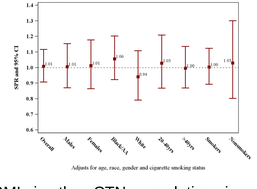


Figure 4. Obesity SPR and 95% CI for CTN Stimulant Users vs. Matched NHANES



Stimulant users have slightly lower prevalence of obesity to the NHANES population irrespective of age, race, or gender (Figure 4) but this difference is not as great as for opiate users versus the matched NHANES population

Figure 5. Obesity SPR and 95% CI for CTN Stimulant Users vs. Matched NHANES



Stimulant users have similar obesity prevalence to the NHANES population irrespective of age, race, gender or smoking status (Figure 5)

Comparison (Unweighted vs. Weighted)	Unweighted Mean BMI (kg/m^2)	Weighted Mean BMI (kg/m^2)	ANOVA P-value
Overall CTN vs. NHANES†	26.6	28.6	<0.0001
Opiate users vs. NHANES†	24.6	28.0	<0.0001
Stimulant users vs. NHANES†	28.3	29.5	<0.0001
Stimulant users vs. NHANES††	28.3	28.6	0.076
Opiate vs. Stimulant users†	24.6	27.5	<0.0001

† Adjusts for age, race, and gender.
†† Adjusts for age, race, gender and cigarette smoking status.

- Mean BMI in the CTN population is significantly lower than NHANES
- Opiate users have lower average BMI than NHANES
- US population has higher BMI than stimulant users, but similar after adjusting for smoking status
- Within the CTN, opiate users have lower BMI than stimulant users

Conclusions

- Overall, BMI is lower in the CTN substance using population than the general US population participating in NHANES
  - ➡ Do abusive drugs inhibit appetite or food intake?
- This difference between CTN and NHANES is driven by the lower BMI of opiate users, since stimulant users have relatively similar prevalence of obesity to the NHANES sample
- When further adjusting for smoking status, any difference between stimulant users and the general US population in the prevalence of obesity diminishes
  - Tobacco is a known appetite inhibitor
  - May explain observed slightly lower rates of obesity in the CTN stimulant users than the NHANES population
  - ➡ Can cigarette smoking explain the lower BMI and obesity prevalence in opiate users relative to the general population?

Limitations

- Potential confounding factors, such as socioeconomic status and general health condition, were not adjusted for (data unavailable)
- Cigarette smoking status was not collected for the CTN trials of primary opiate users so we could not control for this potential confounder
- A convenience sample was used for participants with available age, race, gender and BMI possibly inducing a selection bias
- Polydrug use was not considered

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