

# Decoupling the Independent Effects of Multiple Simultaneous Behavior Changes on Weight Loss



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## Problem

In an ideal experimental world all diet advice is given one suggestion at a time, with an identical control and treatment groups. In real world situations, however, dietitians often give multiple simultaneous diet suggestions tailored for the individual. Assessing data with multiple simultaneous treatments represents challenges, however. With multiple diet suggestions, there may be asymmetric levels of accuracy of following tips even within subject. Fortunately the analysis can be leveraged with additional information about treatment compliance. We explore the benefits and drawbacks to several statistical approaches to uncovering the impact of multiple simultaneous diet suggestions.

## Method

We use a combination of Loess and OLS regression analysis to examine the differential impact of high and low compliance tips. The Loess regression fits the relationship between weight change and compliance non-parametrically from weighted values in a neighborhood of each point. This non-parametric analysis allows us to see the distributional location and magnitude of the impact of compliance on weight change.

## Results

Within subjects, an additional day of adherence to tip **least** adhered to lead to **more** weight loss (.059lbs/day,  $p < .001$ ) than the two other tips (.030 lbs/day,  $p = .001$ ). As can be seen in the Loess plots, the difference is stark for compliance levels less than twenty. For adherence up to twenty days, an additional day of adherence to the least followed tip yields .056lbs weight loss ( $p < .001$ ) where the a day more of any other tip yields no significant weight loss at all. What can we make of this? Do we really think an additional day of the lowest complied to tip yields the most weight loss? Probably not\*. The segment of the non-min Loess distribution *after* 20 days may be the key to unlocking this mystery. After 20 days, each additional day of compliance lead to **0.125 lbs** weight loss ( $p = .005$ ). This is arguably the real daily impact of these diet tips, as an additional day of compliance here is most likely the difference between individuals who are both deliberately and accurately following their treatment.

This logic may help explain the linear nature of the estimates for the tips with lowest compliance. An additional day of compliance for the hardest to follow treatment even early in the distribution is likely to exhibit accuracy that is not seen in following an easier tip until much further in the distribution.

## Proposed Method

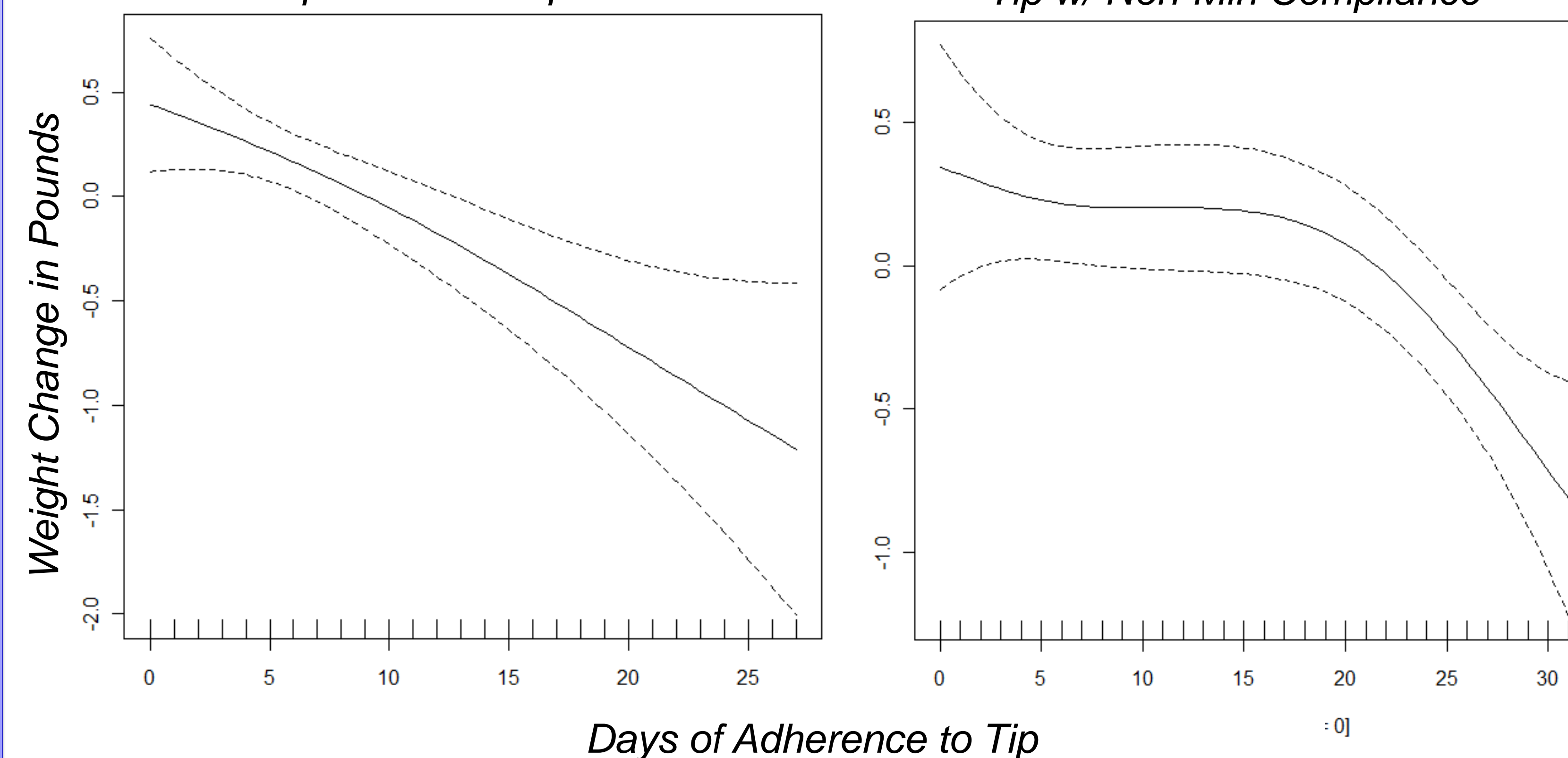
A researcher who is interested in the true impact of treatments that are voluntarily followed can use a non parametric regression such as Loess to determine where compliance thresholds are for more and less accurately followed tips. They can then omit observations that on average were not indicative of the true treatment effect.

## Abstract

When offering weight loss guidance, multiple suggestions are often tailored in different ways to an individual. Because each set of advice may be unique, it is difficult to estimate the individual impact of any single recommendation. This study provided 300 individuals with three of 30 different diet-related behavior changes and tracked their self-reported daily compliance and their weight change over one to three months. Different statistical methods are compared in their ability to separate out the individual impact of these 30 behavior changes on weight loss. The results are useful for researchers who want to better assess which of multiple suggestions are most directly tied to a behavior change, such as weight loss.

Method	Advantages	Disadvantages	Appropriate When
1. Regress weight loss onto each tip. Secondly use compliance data to recover weight change/compliance.	Simple, easy interpretation. Gives weight change impact of being assigned a certain tip. Treats all other treatments and compliance as stochastic noise, which is a familiar approach for empiricists.	This method ignores extra compliance data in estimation. It implicitly gives equal weight to each tip regardless of tip participation.	Compliance varies little between tip within subject, or Compliance data is not obtained or is aggregated.
2. Regress weight loss onto compliance for each tip.	Makes use of adherence data. No data is omitted.	May give credit to adherence that is not true adherence. Often some adherence to easy to follow tips is partial and incidental.	Treatment is difficult to incidentally follow. High compliance among all participants.
3. Use Loess Regression to determine appropriate thresholds for high, med, and low compliance tips. Restrict data accordingly. Regress weight loss onto compliance for each tip.	Makes use of adherence data. Measures full deliberate, not partial incidental adherence. Reduces to method 2 if there is no apparent partial incidental adherence.	Omits collected data by construction. Grey area exists between true threshold and data-mining results.	Large sample size. Treatment adherence is subjective and voluntary. Partial incidental adherence is likely.

Compliance & Weight Change for Tips with Minimum versus Non-Min Compliance  
Estimates of a Loess Non-parametric Regression  
Tip w/ Min Compliance



\*While it seems natural to argue that more restrictive tips would be more effective and harder to follow thus giving the above result, the data simply don't support this story. While the least complied to tips were much harder for the participants (Avg. ease rating of 3.27 /9.00 compared to 5.27/9.00), once compliance is controlled for, ease did not have a significant impact on weight change.

## Bottom Line:

1. Various approaches exist to decouple the effects of multiple simultaneous behavior changes, which are each appropriate given the right situation.
2. With multiple simultaneous diet treatments, adherence is often both subjective and voluntary. In addition, compliance to the easiest of the simultaneous tips is more likely to be incidental. Using Loess Regression or a similar non-parametric method to determine adherence thresholds for tips can give a researcher a much better estimate of individual treatment effects for each of the multiple simultaneous treatments.

## Implications:

While data with multiple simultaneous behavioral changes always represent a great challenge to analyze, this does not mean that diet researches need to avoid such data. As there are many applications in nutrition and dieting where multiple treatments are prescribed at a given time, methods such as the Loess Regression method suggested here can make use of data that would otherwise go underutilized. While analysis of multiple treatment effects one must be careful about inference, these methods can serve to point researchers towards treatments that may be deserving of individual analysis.

## References:

Kothert, K., Strecher, V.J., Doyle, L.A., Caplan, W.M., Joyce, J.S., Jimison, H.B., Karm, L.M., Mims, A.D., Roth, M.A. Web-based Weight Management Programs in an Intergrated Health Care Setting : A randomized, Controlled Trial. *Obesity* 2006.

Wansink, Brian 2010, "From Mindless Eating to Mindlessly Eating Better" *Physiology and Behavior*, (July), forthcoming.

Wansink, Brian, David R. Just, and Collin R. Payne (2009), "Mindless Eating and Healthy Heuristics for the Irrational," *American Economic Review*, 99:2 (May), 165-69.

## For More Information:

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