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Effectiveness of weight loss intervention in highly-motivated people

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ABSTRACT

A variety of approaches have been implemented to address the rising obesity epidemic, with limited success. I consider the success of weight loss efforts among a group of highly motivated people: those required to lose weight in order to qualify for a life-saving kidney transplantation. Out of 246 transplantation centers, I identified 156 (63%) with explicit body mass index (BMI) requirements for transplantation, ranging from 30 to 50 kg/m². Using the United States national registry of transplant candidates, I examine outcomes for 29,608 obese deceased-donor transplant recipients between 1990 and 2010. I use value-added models to deal with potential endogeneity of center choice, in addition to correcting for sample selection bias arising from focusing on transplant recipients. Outcome variables measure BMI level and weight change (in BMI) between initial listing and transplantation. I hypothesize that those requiring weight loss to qualify for kidney transplantation will be most likely to lose weight. I find that the probability of severe and morbid obesity (BMI ≥ 35 kg/m²) decreases by 4 percentage points and the probability of patients achieving any weight loss increases by 22 percentage points at centers with explicit BMI eligibility criteria. Patients are also 13 percentage points more likely to accomplish clinically relevant weight loss of at least 5% of baseline BMI by transplantation at these centers. Nonetheless, I estimate an average decrease in BMI of only 1.7 kg/m² for those registered at centers with BMI requirements. Further analyses suggest stronger intervention effects for patients whose BMI at listing exceeds thresholds as the distance from their BMI to the thresholds increases. Even under circumstances with great potential returns for weight loss, transplant candidates exhibit modest weight-loss. This suggests that, even in high-stakes environments, weight loss remains a challenge for the obese, and altering individual incentives may not be sufficient.

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1. Introduction

The rate of obesity has more than doubled since 1960: 35.7% of the United States adult population is clinically obese (Flegal et al., 2012).² Obesity is strongly associated with coronary heart disease, cardiovascular diseases, and

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² Clinical obesity is defined as body mass index (BMI) of at least 30 kg/m². BMI is a measure of height-adjusted weight defined as the ratio of an individual's weight in kilograms to height in meters squared.

certain types of cancers (National Cancer Institute, 2012). It also intensifies the risk of stroke, a host of chronic diseases such as type II diabetes and hypertension, and chronic mental illness (Onyike et al., 2003; National Institutes of Health Publication, 1998). Approximately 112,000 deaths are attributed to obesity each year (Flegal et al., 2005) and obesity is associated with an important increase in medical care spending (Finkelstein et al., 2009; Cawley and Meyerhoefer, 2012).

Given the costs of obesity, it is not surprising that efforts to incentivize weight loss have been central in health and behavioral economics. Financial incentives, whether employer-based or outside the workplace, have used discounts on services, partial or full reimbursement for fees, health insurance premium credits, and monetary (or cash) payments, with limited success. And when weight loss occurs, results are short-lived (Cawley and Price, 2013). Studies conducted outside the workplace found positive effects for weight loss incentives during relatively short interventions—a few months—but registered significant weight re-gain in follow-up periods (Volpp et al., 2008; Finkelstein et al., 2007; John et al., 2011).

In this study, consideration of a different sample provides a substantial contribution: end stage renal disease (ESRD) patients who are highly motivated to lose weight in order to qualify for kidney transplantation in the United States.³ Though ESRD patients may not be entirely representative of the obese in the general population, the relatively high prevalence of obesity in this population (Kramer et al., 2006) makes it useful to study. For this group, the reward for weight loss is, potentially, life itself—since if they do not lose weight, they are ineligible for transplantation. The impact and saliency of this very large reward for weight reduction—far higher than for any other study—can be used to test several theories regarding incentives to promote weight loss. One, the operant learning theory in psychology, emphasizes the interaction between behavior and environment over time given principles of rewards and punishments (Skinner, 1938). A second is a behavioral economic theory, emphasizing that people behave in a way that maximizes returns (rewards) and that the timing of those returns is very important to the process. Both theories predict that changing the immediate consequences of excess weight may affect behavior and promote weight change over time (Jeffery, 2012). A third is the expectancy theory of motivation in psychology, where the value and salience of the performance reward is positively associated with the amount of effort exerted (Naylor et al., 1980; Vroom and Deci, 1970). This theory predicts that large incentives in weight loss interventions may be associated with stronger response (Jeffery et al., 1983; Gneezy et al., 2011).

The importance and contribution of this analysis are five-fold. First, unlike previous studies, I investigate the effect of a non-financial and extremely large incentive (i.e. life with transplantation) on weight loss that could

otherwise not be investigated in standard random controlled trials. Second, the intervention spans a relatively long period: wait time for deceased-donor kidney transplantation is two years on average. Third, unlike previous interventions, this study uses a large and non-gender segregated sample: 29,608 obese transplant recipients. Fourth, the incentive in this intervention is directly tied to weight loss, an “output-oriented” incentive, as excess weight precludes access to transplantation. Finally, I study effectiveness of a weight-loss intervention in a relatively high-cost and high-need population plagued by obesity (Kramer et al., 2006; Hauboldt et al., 2008; Bentley and Hanson, 2011). I hypothesize that transplant candidates requiring weight loss to qualify for kidney transplantation would be most likely to reduce weight.

I implement value-added models with correction for sample selection bias for obese deceased-donor transplant recipients between 1990 and 2010. I find that the probability of severe and morbid obesity ($BMI \geq 35 \text{ kg/m}^2$) decreases by 4 percentage points and the probability of patients achieving any weight loss significantly increases by 22 percentage points at centers with a defined body mass index (BMI) threshold. Moreover, a significant effect is registered for the probability of clinically relevant weight loss at these centers: obese transplant recipients are 13 percentage points more likely to accomplish weight loss of at least five percent of baseline BMI by the time of transplantation. Nonetheless, the magnitude of that weight loss is modest even with the stakes involved. Transplant recipients lose an average of 1.7 kg/m^2 as a result of BMI requirements.

I go on to exploit variation in BMI thresholds across centers and patients' BMI distribution, focusing on centers with explicit BMI-related eligibility requirements for transplantation. I find that the intervention effect is stronger for patients with BMI above thresholds as the distance between their BMI at listing and the thresholds increases.

Transplant candidates exhibit weight-loss behavior consistent with the objective of obtaining an organ transplantation as a result of BMI criteria. However, the average absolute weight loss estimates point to challenges when using incentives as commitment devices in influencing healthy behavior of the obese. Although transplantation is an ideal outcome for ESRD patients, obese candidates subject to BMI thresholds have yet to incur substantial weight loss on a general basis.

The remainder of the paper is structured as follows. The institutional background surrounding transplantation and BMI eligibility requirements is presented in Section 2. The data are described in Section 3. Section 4 explains the empirical strategy. Results are reported in Section 5, followed by discussion of these results.

2. The transplantation process and BMI eligibility criteria

2.1. Institutional context

In order to be enrolled on a center's waiting list, a potential candidate is evaluated based on eligibility

³ This analysis only pertains to adult ESRD patients on the waiting list for transplantation. As such, changes in weight will translate to changes in BMI.

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