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SELF-CONTROL AND UNHEALTHY BODY WEIGHT: THE ROLE OF IMPULSIVITY AND RESTRAINT

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NON-TECHNICAL SUMMARY

Once viewed as an issue only in affluent countries, obesity has become a global concern following the dramatic increase in obesity in low- and middle-income countries. Excess body weight not only harms people's health by raising the risk of cardiovascular disease, stroke, diabetes, and some cancers, it also reduces economic well-being by constraining economic participation, decreasing productivity, and reducing income. Many of the risk factors driving these illnesses (e.g., tobacco use, alcohol abuse, unhealthy nutrition, limited physical activity) are preventable, raising questions about why some people make heathier choices than others. Answering this question has the potential to enhance public health efforts to combat the global rise in obesity and obesity-related noncommunicable diseases.

Our research examines the relationship between limited self-control and both objective (obesity, BMI, waist-to-height) and subjective measures (weight satisfaction, ideal vs. actual weight) of unhealthy weight. While much of the existing evidence comes from small, selected samples, we make an important contribution by exploiting data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Survey is one of only two population representative data sources that now include a well-established measure of trait self-control – the Brief Self-Control Scale (BSCS) (Tangney et al., 2004). The Self-Control Scale is the most widely used measure of trait self-control in psychological research on self-regulation and self-control.

We find that those with limited self-control have an unhealthier body weight and poorer subjective weight-related well-being. Thus, there may be beneficial population health consequences from supporting people's capacity for self-control. We then develop an empirical method that uses the 13 items in the BSCS to isolate two core factors shaping people's self-control – impulsivity and restraint. Our results show that high impulsivity and low restraint are only modestly correlated; each has differential predictive power. While body weight, physical activity and dieting are more strongly associated with people's restraint, their degree of impulsivity is more important in understanding their decisions about when, where, and what to eat.

These insights have important implications for the specific policy tools we use to address unhealthy weight. If the goal is weight reduction, improving weight-related subjective well-being, or increasing physical activity, then our results indicate that the policy focus should primarily be on increasing restraint rather than reducing impulsivity. Impulsivity is relatively more important if we wish to influence when and where people eat or improve their nutrition levels. Given this, we may be able to improve dietary self-

control through interventions that slow decision making down or speed up the processing of food's health attributes. One potential strategy for achieving this may be for policy to target the `time price' of food consumption by increasing the time it takes to purchase and consume unhealthy food, while decreasing the time necessary for the purchase and consumption of healthy food.

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ABSTRACT

We examine the relationship between trait self-control and body weight. Data from a population representative household survey reveal that limited self-control is strongly associated with both objective and subjective measures of unhealthy body weight. Those with limited self-control are characterized by reduced exercising, repeated dieting, unhealthier eating habits, and poorer nutrition. We propose an empirical method to isolate two facets of self-control limitations-high impulsivity and low restraint. Each has differential predictive power. Physical activity, dieting, and overall body weight are more strongly associated with restraint; impulsivity is more predictive of when, where, and what people eat.

Keywords: Brief Self-Control Scale, Obesity, Body Mass Index, Diet, Exercise

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1 Introduction

Nearly three quarters of all deaths globally are now attributable to noncommunicable diseases such as cardiovascular disease, cancer, respiratory diseases, and diabetes (World Health Organization, 2021). Many of the risk factors driving these illnesses (e.g., tobacco use, alcohol abuse, unhealthy nutrition, limited physical activity) are preventable, leading economists to view unhealthy lifestyle choices as a form of inter-temporal risk-taking (Cawley and Ruhm, 2011). This perspective—along with the enormous public health burden generated by these choices—has intensified interest in the behavioral foundations of health behavior as researchers strive to understand why some people make healthier choices than others. A great deal of work remains to be done. However, it is increasingly clear that healthy lifestyle choices such as not smoking, limiting alcohol, and maintaining a healthy weight are shaped, at least in part, by people's personality traits, future orientation, time-preferences, and risk attitudes (e.g., Borghans and Golsteyn, 2006; Chiteji, 2010; Cobb-Clark et al., 2014; Courtemanche et al., 2015; Gruber and Kőszegi, 2001; Stoklosa et al., 2018; Sutter et al., 2013).[1]

Our research examines the relationship between limited self-control and unhealthy body weight. Once viewed as an issue only in affluent countries, obesity has become a global concern following the dramatic increase in obesity in low- and middle-income countries (World Obesity Federation, 2020). Excess body weight not only harms people's health by raising the risk of cardiovascular disease, stroke, diabetes, and some cancers (Centers for Disease Control and Prevention, 2021), it also reduces economic well-being by constraining economic participation, decreasing productivity, and reducing income (e.g., Tremmel et al., 2017). Understanding the behavioral underpinnings of unhealthy weight has the potential to enhance public health efforts to combat the global rise in obesity and obesity-related noncommunicable diseases.

Self-control can be conceptualized as "the ability to override or change one's inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them" (Tangney et al., 2004, p. 275).[2] Seen in this light, it seems almost tautological that maintaining a healthy weight must require a degree of self-control. Empirical evidence in sup-

[1] See Cawley and Ruhm (2011) and Pastore et al. (2020) for recent reviews.

[2] Self-control is one of the most studied concepts in social science (Duckworth and Kern, 2011). Self-control is closely related to concepts such as self-regulation, impulsivity, delay of gratification, inattention, hyperactivity, executive function, willpower, and conscientiousness which have been widely studied in psychology and neuroscience (Moffitt et al., 2011). See Hoyle and Davisson (2016) for a review of the correlation between self-control and other personality traits.

port of this proposition is surprisingly limited, however. Economists have only recently begun to examine the relationship between time-inconsistent preferences and obesity (Stoklosa et al., 2018), while in psychology "surprisingly few studies have explored the intuitive connection between self-control and weight loss" (Crescioni et al., 2011, p. 750). Those that do produce mixed results. Although Crescioni et al. (2011) find that higher self-control is associated with improved results in a weight-loss program, others conclude that self-control is only a weak predictor of eating behavior (de Ridder et al., 2011) and exerting self-control through dieting may not result in weight loss (see Kuijer et al., 2008).

Our study makes an important contribution by using population representative data to analyze the relationship between self-control and both objective (obesity, BMI, waist-to-height ratio) and subjective measures (weight satisfaction, ideal vs. actual weight) of unhealthy weight. While much of the existing evidence comes from small, selected samples, we exploit data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey which is a large household panel survey. The HILDA Survey is one of only two population representative data sources that now include a well-established measure of trait self-control—the Brief Self-Control Scale (BSCS) (Tangney et al., 2004). The Self-Control Scale is the most widely used measure of trait self-control in psychological research on self-regulation and self-control. Most researchers use the scale to construct a single index capturing the general capacity to exert self-control. However, efforts to conceptually (de Ridder et al., 2011) and empirically (Maloney et al., 2012) differentiate between the items suggest the scale may capture two forms of self-control rather than one (see Hoyle and Davisson, 2016).[3]

Drawing on this insight, we begin by proposing an empirical method that uses the 13 items in the BSCS to isolate two core factors shaping people's self-control—impulsivity and restraint. Empirically distinguishing between these conceptually different facets of self-control has several advantages. First, it provides a bridge between our work, that of other economists, and the vast literature on the psychology of obesity which is founded on more nuanced notions of self-regulation. Second, it allows us to contribute to the behavioral social science literature which is increasingly demonstrating the predictive power of multi-dimensional notions of self-control that account for sophistication (Cobb-Clark et al., 2021a) as well as impulsivity and risk-seeking

[3] Hoyle and Davisson (2016) refer to these factors as "control over impulses" and "capacity to initiate desired behaviors" (p. 398).

(Forrest et al., 2019). Finally, it provides a richer understanding of the behavioral origins of unhealthy weight and sheds light on new policy options for improving health outcomes.

In particular, we find that those with limited self-control have an unhealthier body weight and poorer subjective weight-related well-being. Thus, there may be beneficial population health consequences from supporting people's capacity for self-control. The way that self-control limitations are manifested matters. High impulsivity and low restraint are only modestly correlated; each has differential predictive power. While physical activity and dieting are more strongly associated with people's restraint, their degree of impulsivity is more important in understanding their decisions about when, where, and what to eat. These insights have important implications for the specific policy tools we use to address unhealthy weight.

2 Conceptual Framework: Self-Control and Unhealthy Body Weight

Body weight is determined not only by physiology, but also by the lifestyle choices that drive calories consumed and expended (Harvard Health Publishing, 2019). Psychologists and economists both understand the self-regulation of food intake and physical activity as the exercise of self-control (e.g., DellaVigna and Malmendier, 2006; Hagger et al., 2010; Herman and Polivy, 2004; Ruhm, 2012).[4] Despite disciplinary differences in language and theoretical foundations, there are many similarities in the way that economists and psychologists conceptualize the behavioral foundations of unhealthy body weight.

Psychologists have a long tradition of viewing impulsivity and restraint as key aspects of human behavior (see Carver, 2005), believing that "there is predictive and explanatory benefit to be gained from measuring capacity for each form of self-control" (Hoyle and Davisson, 2016, p. 399). Impulsivity refers to a predisposition toward rapid, unplanned reactions to stimuli, without regard to the negative consequences (DeYoung and Rueter, 2016), while restraint refers to the tendency to reflect and deliberate before acting (Carver, 2005). The psychological distinction between restraint and impulsivity as facets of self-control has proven particularly helpful in understanding weight-related behavior. Recent meta-analyses conclude, for example, that dispositional (trait) self-control is only weakly related to eating behavior and weight control (de Ridder et al., 2012), while impulsivity is positively associated with BMI (Emery and Levine,

[4]Psychologists view self-control as only one form of self-regulation. Broadly speaking, self-control involves the effortful inhibition of impulses in the presence of conflict between motives (Inzlicht et al., 2021).

2017). There is also a view that restrained eating (dieting) in the absence of the ability to control one's impulses (inhibition) is likely to be unsuccessful and may result in problematic eating patterns (see Kuijer et al., 2008). The take-away message is that most people will struggle to maintain a healthy weight without a degree of restrained eating (i.e., dieting) and some ability to resist impulsively giving in to temptation.

Drawing on these psychological foundations, economists often conceptualize and model self-control as the internal conflict decision makers face when confronted with competing interests (Fudenberg and Levine, 2006, 2011, 2012; Loewenstein and O'Donoghue, 2004; Shefrin and Thaler, 1988; Thaler and Shefrin, 1981). Moving beyond the standard, unitary-preference approach has highlighted that prices and food budgets are only a partial explanation for the rise in unhealthy weight. In particular, Ruhm (2012) proposes a dual decision model in which eating reflects the combined influence of: (i) a deliberative (utility maximizing) system; and (ii) an affective system that responds impulsively to stimuli without accounting for the consequences. He concludes that the trend in rising body weight is unlikely to be the result of increases in people's optimal weight. Rather, advances in food engineering which focus on stimulating the affective system may be contributing to the rise in BMI. Importantly, there is also evidence that impulsivity matters. People who report that they often spend money without thinking, or spend more than they should, have larger fluctuations in their relative spending on unhealthy vs. healthy food, suggesting they have greater self-control problems (Cherchye et al., 2020).

Impulsivity may matter for weight control in part because of the way we process information about food. Psychologists suggest that dietary self-control may be challenging because the anticipated taste of foods is more easily weighted in the consumption decision than are more abstract attributes like the food's nutritional content (Liberman and Trope, 2008). Neuroscientists have identified neural mechanisms underlying the way that people with good vs. poor self-control compute the taste and health attributes of food before they consume it (Hare et al., 2009). The overall value of food is represented in the ventromedial prefrontal cortex. However, this area of the brain responds only to the taste of food if people have low self-control; it responds to both taste and health attributes if people have high self-control. Sullivan et al. (2015) suggest that the difference may be at least partially due to the speed with which the brain's decision-making circuitry processes taste vs. health attributes. They provide evidence that taste information is processed approximately 9 percent faster than health information.

Self-control is not only about resisting temptation, but also about avoiding it altogether. In effect, people with high self-control are more successful in self-regulation because they do not put themselves in a position of needing it (de Ridder et al., 2012; Hofmann et al., 2012). They establish effective routines and habits, for example, which result in them being less reliant on exerting self-control (Adriaanse et al., 2014; Fujita et al., 2006). They may also restrict their own ability to make certain choices through contractual arrangements and other forms of commitment devices (e.g., Fudenberg and Levine, 2006; Gul and Pesendorfer, 2001; Laibson, 1997; O'Donoghue and Rabin, 1999).[5]

3 Data and Methods

3.1 Data

Our analysis is based on data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Survey is a population representative household panel, surveying more than 17,000 Australians annually. Started in 2001, the HILDA Survey provides rich information on many aspects of life, including people's socioeconomic conditions, family background, and health. Importantly, in 2019 the HILDA Survey included for the first time the Brief Self-Control Scale (BSCS; see Tangney et al., 2004), making it one of only two large-scale population representative datasets that contain a direct measure of people's trait self-control.[6] The large sample size, long study period, and rich information on body weight and weight-related behaviors make the HILDA Survey data ideal for studying the issue at hand.

Measuring Self-Control: The BSCS is a 13-item battery of questions that measures general trait self-control. It is highly correlated with the (full) 36-item Self-Control Scale, has high internal consistency and test–retest reliability, and is predictive of key life outcomes (Bertrams and Dickhäuser, 2009; Cobb-Clark et al., 2021b; Tangney et al., 2004). Individuals respond using a five-point Likert scale ranging from 1 ("not at all") to 5 ("very well") to indicate

[5]See Schilbach (2019) for an overview of the evidence on the demand for commitment in health-related behaviors.

[6]The other dataset is the German Socio-Economic Panel's Innovation Sample (SOEP–IS). While also population representative, SOEP–IS administered the BSCS to only around 2,000 individuals. It also lacks some of the rich information on weight, weight-related well-being, physical activity, eating habits, and nutrition that is available in the HILDA Survey data.

how well the 13 items reflect how they typically are. The items assess, for example, whether people have a hard time breaking bad habits, can resist temptation, or act without thinking. For the full list of items, see Table 1. We calculate a continuous aggregate measure that is increasing in self-control limitations by taking the average across all 13 items. We define people as having limited self-control if their score is in the top quartile of the distribution. Along with capturing trait self-control, the BSCS enables us to extract separate measures of both impulsivity and restraint. Details are presented in Section 3.2.

Body Weight Measures: The HILDA Survey asks respondents about their health and health behaviors in great detail. This provides an opportunity to study people's unhealthy body weight using a rich set of both objective and subjective measures and to investigate potential mechanisms. Specifically, we analyze various measures of objective unhealthy body weight including: current body weight (in kg); Body Mass Index (BMI); and indicators for being overweight or obese.[7] While BMI is the most commonly used measure of unhealthy weight, it is a simple index of weight-for-height and may not correspond to the same degree of fatness in different people. Some experts, therefore, suggest that waist-to-height ratio is a better screening tool for obesity-related cardiometabolic health risk factors (see Ashwell et al., 2012). In particular, a waist-to-height ratio of 0.5 or higher has been shown to be more predictive of early health risks associated with obesity than BMI (Ashwell and Gibson, 2016; Browning et al., 2010). Consequently, in 2017 the HILDA Survey gave respondents a tape measure and asked them to report their waist measurement. We use this information to extend our analysis by investigating key measures of people's waist circumference: waist circumference (in cm); waist-to-height ratio; and an indicator for having a waist-to-height ratio of 0.5 or higher.

Along with these objective weight outcomes, we also investigate people's perceptions of their own weight-related health. Specifically, respondents report how satisfied they are with their current weight (reported on a five-point scale) and whether they rate themselves as overweight (relative to normal or underweight). Respondents are also asked about their desired weight in one year's time (i.e., in 2020). In addition to analyzing how self-control is associated with people's ideal weight, we also investigate the deviation between current and ideal weight (in kg) as an additional measure of weight-related well-being.

[7] BMI is defined as a person's weight in kilograms divided by the square of their height in meters (kg/m^2). We follow the World Health Organization's thresholds to define overweight by a BMI of 25 and above and obesity by a BMI of 30 and above.

Finally, the 2017 HILDA Survey includes an extensive questionnaire around people's exercising and eating habits, allowing us to investigate the key mechanisms underpinning unhealthy weight in great depth. In particular, we focus on both physical activity and walking, as well as on the consumption of specific foods and general eating habits, such as eating away from home. See Appendix Table A.1 for a full list of variables and their definitions.

Sample: We base our analysis primarily on data drawn from the 2019 wave of the HILDA Survey. Our analysis sample includes all respondents with complete information on the BSCS (15,463 observations).[8] Focusing on our key objective weight outcomes, we drop respondents with item non-response for either current body weight or height (494 observations). We also exclude 32 observations with incomplete information on the set of control variables that we include in all our analyses: gender, age, state, Aboriginal status[9], first- and second-generation immigration background, marital status, own and parental education, and equivalized household disposable income. Thus, our final sample consists of 14,937 individuals. However, sample sizes for some outcomes are lower.[10] Complete summary statistics for all outcome and control variables are reported in Tables A.2 and A.3, respectively.

We investigate the representativeness of our analysis sample by comparing key summary statistics for our analysis sample with the sample of all those responding to the 2019 HILDA Survey's self-completion questionnaire (see Table A.4). We find that there are very few significant differences in mean characteristics across these two samples. Our analysis sample includes slightly fewer Aboriginal people and people who have an educational attainment of year 11 (or less), while those who are married are somewhat over-represented. Average disposable income is also slightly higher in our analysis sample. Most of these differences are, however, quite small suggesting they are economically unimportant. All other characteristics are well-balanced. Thus, despite the necessary sample restrictions, our analysis sample appears to be generally representative of the overall Australian population. Importantly, we do not observe

[8]687 out of 16,150 people who responded to the HILDA Survey's self-completion questionnaire in 2019 have no or incomplete BSCS information.

[9]For simplicity, we use the term 'Aboriginal' to refer to both Aboriginal and/or Torres Strait Islander people—the Indigenous peoples of Australia.

[10]The sample size varies because of differential item non-response in the outcome variables. In addition, in some analyses, we exclude 32 observations which we believe have errors in the coding of ideal weight. These are people reporting an ideal weight of more than 20 percent above their current weight, which at the same time would yield an 'ideal' BMI of 40 or higher, indicating morbid obesity.

any difference in the average 13-item BSCS score across the two samples. This indicates that weight-related non-response does not appear to be systematically linked to people's self-control.

3.2 Isolating Impulsivity and Restraint

The BSCS is almost always used to construct a single index capturing the general ability to exert self-control. There is, however, both conceptual and empirical support for using the BSCS to differentiate between different facets of self-control (de Ridder et al., 2011; Hoyle and Davisson, 2016; Maloney et al., 2012). Consequently, we propose a method for using the BSCS to empirically differentiate between two latent types of self-control which we characterize as "impulsivity" and "restraint". This allows us to not only shed light on the relationship between limited self-control and unhealthy body weight, but also to gain a better understanding of the differential predictive power of these two types of self-control issues.

Specifically, we undertake a principal component analysis (PCA) of 11 of the 13 BSCS items, disregarding the items "I am lazy" and "I have trouble concentrating".[11] Conducting an unrestricted PCA on these items produces two separate factors with eigenvalues above one. We restrict our analysis to these two factors and rotate them to be orthogonal. The resulting factor loadings for the two components are given in Table 2 and illustrated in Figure 1. They demonstrate a clear separation of the BSCS items, with each either loading heavily on the first or on the second component, but never on both. The first component includes saying inappropriate things, doing bad things when they are fun, being kept from getting work done because of pleasure and fun, not being able to stop doing something even when knowing it is wrong, and acting without thinking. As all these items indicate some lack of impulse control, we interpret these items from the BSCS as capturing "impulsivity". The second component loads on the ability to resist temptation, breaking bad habits, refusing bad things, having self-discipline, and working effectively toward long-term goals. It is thus more related to people's general capacity for deliberation and inhibition, giving us a measure of "restraint". We calculate two continuous scores that are increasing in impulsivity and in restraint limitations, respectively, by constructing a factor score for each component. Based on these scores, we define people as

[11] The BSCS was drawn as a subset from the original 36-item Self-Control Scale which contained five different factors. After personal correspondence with June Tangney, we disregard the laziness indicator because it stems from the factor "work ethic" which is not directly relevant to our notion of self-control. We disregard the concentration indicator because conceptually it was not obviously related to either impulsivity or restraint. Our empirical results are robust to including these two items in the calculation of impulsivity and restraint.

highly impulsive if their impulsivity score is in the top quartile and as low in restraint if their restraint limitations score is in the top quartile.

Validation: We investigate the validity of this approach to characterizing impulsivity and restraint using additional information from the 2017 HILDA Survey. Specifically, as part of a battery of questions taken from the World Bank Survey of Financial Capability, respondents were asked three questions about their degree of impulsivity, with one question directly asking whether they are impulsive.[12] For each item of the BSCS, we calculate the Pearson's correlation with both the three-item measure of impulsivity (calculated as a simple average) as well as the single impusivity item from the World Bank Survey (see Table 3). These correlations support our overall differentiation between the BSCS items. The five items that make up our "impulsivity" component have consistently higher correlations with both the three- and single-item World Bank measures than do those that load more heavily on the "restraint" component. Importantly, our overall BSCS "impulsivity" component has a substantially higher correlation with the three-item World Bank measure of impulsivity (0.419) than does our BSCS "restraint" component (0.262).

In related research, Maloney et al. (2012) use eight of the 13 BSCS items to elicit impulsivity and restraint in a small (n=909) convenience sample of adults from the U.S. Midwest. Their approach disregards several key items, which we include, perhaps reducing information. Nonetheless, the separation across impulsivity and restraint of the BSCS items they do consider is identical to ours, lending further support to the validity of our approach.

Correlation: Our measures of impulsivity and restraint are moderately correlated. There is a correlation of 0.50 between the continuous scores and a tetrachoric correlation of 0.46 between indicators for high impulsivity and low restraint.[13] Hoyle and Davisson (2016) argue that correlations of 0.50 to 0.60 between two types of self-control are "strong enough to suggest that we have captured two types of the same capacity but not so strong as to suggest conceptual redundancy" (p. 399).

One consequence of this is that those with low restraint are not necessarily the same people as those who exhibit high impulsivity. We investigate who is more vulnerable to these two types of

[12]The three items are: "I do things without giving them much thought"; "I am impulsive"; and " I say things before I have thought them through". Each is answered on a scale from 1 ("strongly disagree") to 7 ("strongly agree").

[13]The joint distribution of impulsivity and restraint is depicted in Figure A.1 in the Appendix.

self-control failures by documenting how mean demographic and socio-economic characteristics vary for people with low vs. high impulsivity and restraint, respectively, and by reporting the results (p-values) from standard t-tests of the equality of means (see Table A.5).

Those who are highly impulsive or lack restraint are younger on average, which is consistent with self-control increasing with age (Cobb-Clark et al., 2019). Similarly, being married is associated with both lower impulsivity and higher restraint, whereas never having been married and Aboriginal status are associated with higher impulsivity and lower restraint. Interestingly, first-generation immigrants are less inclined to be highly impulsive or low in restraint, while the reverse is true for second-generation immigrants.

At the same time, high impulsivity and low restraint do not always characterize the same people. Women, for example, are significantly more likely to lack restraint, yet significantly less likely to be highly impulsive, compared to men. Similarly, having a higher income and being better educated are associated with a lower tendency for impulsivity; yet there is either no, or only a modest, relationship with restraint. Interestingly, rather than being a protective factor, higher parental education is associated with both an increased likelihood of being impulsive and lacking restraint.

3.3 Empirical Strategy

We study the overall association between self-control and people's body weight by estimating the following model:

$$Y_i = \alpha + \beta SC_i + \boldsymbol{X}_i'\gamma + \epsilon_i, \qquad (1)$$

where Y_i is our body weight outcome of interest for individual i. Moreover, SC_i is an indicator for having limited self-control, $\boldsymbol{X}_i$ is a vector of controls (gender, Aboriginal status, first- and second-generation immigration background, marital status, own and parental education, household income, as well as age and state fixed effects), and ϵ_i is an error term.[14]

To investigate the separate influence of impulsivity and restraint as well as any compounding effect, we estimate the following equation in a next step:

$$Y_i = \tilde{\alpha} + \tilde{\beta}_1 I_i + \tilde{\beta}_2 R_i + \tilde{\beta}_3 I_i * R_i + \boldsymbol{X}_i'\tilde{\gamma} + \varepsilon_i, \qquad (2)$$

[14]Our findings are robust to excluding potentially endogenous factors, i.e., marital status, own education, and household income as control variables. Results are available upon request.

where Y_i and $\boldsymbol{X}_i$ are defined as above and ε_i is an error term. In addition, I_i is an indicator for high impulsivity and R_i is an indicator for low restraint. Thus, $\tilde{\beta}_1$ and $\tilde{\beta}_2$ capture the association between being highly impulsive and having low restraint, respectively, while $\tilde{\beta}_3$ captures the additional impact of being both highly impulsive and having low restraint.

We account for multiple hypothesis testing by providing Romano-Wolf p-values, in addition to conventional p-values.[15] Romano-Wolf p-values account for the family-wise error rate when performing multiple hypothesis tests, which conventional p-values do not. While more conservative, the Romano-Wolf p-values generally confirm our conclusions based on conventional p-values.

Because we have only a single measure of people's BSCS, we are not able to assess the stability of self-control over time using our data. Cobb-Clark et al. (2021c) provide evidence, however, that the BSCS exhibits a high degree of mean-level, rank-order, and individual-level stability over the medium term in a representative sample of the German population. Finding support for rank-order stability is particularly noteworthy, given that it is a defining aspect of personality traits (Golsteyn and Schildberg-Hörisch, 2017). Importantly, Cobb-Clark et al. (2021c) find that changes in self-control are not associated with major life events, including the onset of the COVID-19 pandemic, nor are they economically important. The evidence that the BSCS provides a stable measure of trait self-control that is exogenous to key life events goes a long way toward eliminating threats to causality. At the same time, we are not able to test this stability assumption in our data. Consequently, we do not claim to have achieved causal estimation and instead regard ours as a descriptive analysis.

4 Results

4.1 Unhealthy Body Weight

We begin by investigating the association between limited self-control and unhealthy body weight using the model specified in equation (1). Estimation results for objective and subjective weight outcomes are presented in Panel A of Tables 4 and 5, respectively. We then use the model specified in equation (2) to estimate the disparity in body weight associated with high impulsivity and low restraint, reporting these results in Panel B.

[15] We use the Stata ado file `rwolf` by Damian Clarke, see Clarke et al. (2020).

Limited self-control is associated with significantly unhealthier weight across all of the outcomes we consider. Those with limited self-control weigh 4.2kg (5.3 percent) more than those with no self-control limitations; their BMI is 1.4 points (5.2 percent) higher; they are 8.5 percentage points (pp.; 14.1 percent) more likely to be overweight; and 8.4 pp. (31.5 percent) more likely to be obese. They also have a waist circumference that is 4.2cm (4.5 percent) larger than that of people without self-control limitations. Consequently, their waist-to-height ratio is 0.024 (4.4 percent) higher, resulting in a 9.4 pp. (13.5 percent) increase in the chance their waist-to-height ratio exceeds the 0.5 threshold denoting an unhealthy waist circumference.

People with limited self-control not only have an unhealthier body weight on objective weight measures, their subjective weight-related well-being is also poorer. They are less satisfied with their own weight (0.395 standard deviations) and are 16.1 pp. more likely to describe themselves as overweight. Interestingly, weight perceptions appear to be more sensitive to limited self-control than are objective weight-related outcomes. The association between limited self-control and believing oneself to be overweight is nearly twice as large as the increase in the chances of objectively being classified as overweight (8.5 pp.) using the World Health Organization's threshold (i.e., BMI $\geq$ 25). At the same time, those with limited self-control report ideal weights that are only 1.3kg (1.8 percent) higher than those of people without self-control constraints, despite weighing 4.2kg (5.3 percent) more on average. As a consequence, the gap between current and ideal weight is 2.9kg (45.5 percent) greater for those with limited self-control. Lower self-control results in greater conflict between current desires and longer-time goals (Hofmann et al., 2014), perhaps leading people to modify their aspirations in response.

Differentiating between the core factors underlying people's self-control—impulsivity and restraint—reveals that both matter. There is a significant weight penalty attached to high impulsivity and low restraint regardless of the objective (see Table 4, Panel B) or subjective (see Table 5, Panel B) weight outcomes we consider. It is apparent, however, that low restraint is more important than high impulsivity in understanding unhealthy body weight. The estimated effect of low restraint is generally at least twice that of high impulsivity—a difference which is statistically significant and quantitatively important. Those with low restraint weigh 5.4kg more on average, for example, giving them a BMI that is 1.9 points higher. In contrast, those who are highly impulsive weigh only 1.9kg more than others and have a BMI that is 0.7 points higher.

While it has been argued that impulses matter more in driving behavior when people have limited trait self-control than when they do not (see Friese and Hofmann, 2009), we do not find that to be the case here. The interaction between high impulsivity and limited restraint, in fact, usually indicates an offsetting rather than compounding effect, especially when we consider our objective weight measures. Although our estimated interaction effects are only occasionally statistically significant, they are large enough to be economically meaningful. In the case of being overweight or obese, for example, low restraint combined with high impulsivity fully offsets the overall weight penalty associated with high impulsivity.[16]

Taken together, our results clearly indicate that people's body weight is related to their capacity for self-control. Unhealthy body weight is largely about low restraint rather than high impulsivity. People who are low in restraint have substantially worse objective and subjective weight outcomes, largely irrespective of whether they are impulsive or not. Those who are low in restraint weigh, for example, 6.1kg more when they are also impulsive and 5.4kg more when not. In contrast, those who are restrained, but highly impulsive, have only slightly worse weight outcomes than those who experience neither type of self-control issue. This is consistent with Emery and Levine (2017) who conduct a meta-analysis and conclude that, while higher levels of impulsivity are associated with higher BMI, the overall effect size is small, leaving much of the heterogeneity in BMI unexplained. Explicitly considering people's capacity for restraint—in conjunction with their level of impulsivity—allows us to provide a much more nuanced understanding of the factors driving unhealthy body weight.

4.2 The Mechanisms

People's weight is determined by genetic and environmental factors as well as lifestyle choices, such as calorie intake, exercise, stress, and lack of sleep (Harvard Health Publishing, 2019). Exercising and healthy dietary choices are therefore two important tools for achieving, and maintaining, a healthy body weight.[17] Previous research has demonstrated the importance of

[16]As a sensitivity test, we replicated our analysis classifying people as having limited self-control, high impulsivity, or low restraint if their score is in the top decile rather than top quartile of the distribution. As expected, in most cases, effects become stronger when we focus on this stricter definition of self-control limitations. Results are available upon request.

[17]Meta-analysis suggests that weight loss programs combining both diet and physical activity are more effective than those focusing on diet or on physical activity alone (Johns et al., 2014).

self-control for healthy eating and exercise behavior (see, e.g., Crescioni et al., 2011; Hankonen et al., 2014; Junger and van Kampen, 2010; Keller et al., 2016), making it likely that these are the key pathways linking limited self-control to unhealthy body weight.

We make a contribution by conducting a comprehensive analysis of a broad range of lifestyle choices around exercising and eating. Our goal is to develop a better understanding of the reasons that self-control issues are linked to unhealthy body weight. We begin by focusing on the association that the overall capacity for self-control has with people's physical activity, eating habits, and overall nutrition level. We then extend our analysis by considering the distinctive roles of impulsivity and the capacity for restraint.

4.2.1 Physical Activity

Physical activity is one of the cornerstones of weight management. We assess the relationship between self-control and physical activity using measures of (i) vigorous activity; (ii) moderate activity; and (iii) walking. In each case, we consider both the incidence of being active as well as the amount of time (in minutes) spent in physical activity. In addition, we utilize the Metabolic Equivalent of Task (MET, in minutes) to capture total physical activity.[18] Variable definitions are provided in Appendix Table A.1 (see Wooden, 2014, for further details).

Across the board, we find that people with limited self-control are less physically active than are those without self-control issues (see Table 6, Panel A). They are 6.1 pp. (13.3 percent) less likely to do any vigourous exercise; 3.9 pp. (6.4 percent) less likely to engage in any moderate activity; and, as a result, spend less time in either vigorous (28.6 minutes) or moderate (17.2 minutes) activity each week. People with self-control issues also walk substantially less than their more self-controlled counterparts. As a consequence, the total MET physical activity for those with limited self-control is 6.5 hours (16.7 percent) lower each week than for those without self-control limitations. These findings on the positive relationship between exercise and overall self-control are consistent with previous studies (Crescioni et al., 2011; Junger and van Kampen, 2010). Moreover, Crescioni et al. (2011) conclude that, not only do those with greater self-control exercise more throughout a 12-week weight loss program, they are much more successful in reducing their body weight by the end of the program. Increased physical

[18]The total MET score is a summary measure for minutes spent being physically active. Walking has, for instance, a loading of 3.3, i.e., ten minutes walking enter the MET as 33 minutes of physical activity, see Table A.1.

activity thus appears to be one channel through which a heightened capacity for self-control leads to healthier body weight.

Crucially, it is a lack of restraint—rather than high impulsivity—that undermines people's physical activity. With only one exception, low restraint has a significantly negative, and substantial, association with physical activity (see Table 6, Panel B). In contrast, the estimated effect of high impulsivity is often not significant and we generally reject the hypothesis that the estimated effects of restraint and impulsivity are the same.

4.2.2 Eating Habits

Many people also attempt to manage their weight through restricting their food consumption, i.e., dieting. Many experts argue, however, that dieting may promote problematic eating patterns leading to weight gain rather than weight loss (see Kuijer et al., 2008, and the references therein). Our focus is on two dieting outcomes: (i) whether people are currently dieting to lose weight; and (ii) whether they have attempted more than two diets (or were continuously dieting) in the last year.

Dieting is associated with having more limited self-control. In particular, people with low self-control are 6.1 pp. more likely to currently be on a diet to lose weight and 9.1 pp. more likely to have attempted at least two diets (or be constantly dieting) to lose weight (see Table 7, Panel A). These disparities are relatively large, amounting to an increase of 33.9 percent in currently dieting relative to the mean and an increase of 42.3 percent in repeat dieting. This is perhaps not surprising. Limited self-control is associated with higher body weight as well as a larger disparity between ideal and actual weight (see Table 4) and lower weight satisfaction (see Table 5), all of which may lead people to engage in more dieting.[19] At the same time, repeated dieting may be an indication that those with limited self-control are more likely to fail at using dieting to lose weight. Consistent with this, Keller and Siegrist (2014) find that successful, restrained eating is facilitated by high dispositional self-control. Similarly, Kuijer et al. (2008) provide evidence of better decision making and more ability to resist temptation among dieters who are high in self-control, suggesting that they may be more successful in their dieting attempts.

[19]Controlling for the gap in people's actual and ideal weight does not substantively alter our findings.

Previous researchers have linked increased BMI and waist circumference to skipping breakfast (Watanabe et al., 2014), while men's tendency to be overweight is positively related to how often they purchase meals away from home (Bezerra and Sichieri, 2009). Consequently, we investigate the link between self-control and both of these eating habits. We find that those with limited self-control are 29.3 percent (0.4 times per week) more likely to skip breakfast. They are also 14 to 20 percent more likely to purchase breakfast, lunch, and dinner outside of their home. Thus, limited self-control may be associated with unhealthy weight, at least in part, through these eating habits.

As is the case for physical activity, and indeed body weight overall, restraint is significantly more important than impulsivity in predicting dieting behavior (see Table 7, Panel B). Those lacking restraint are 43.9 percent more likely to be currently on a diet; they are 43.3 percent more likely to have engaged in repeated dieting over the year. In contrast, the association between dieting and impulsivity is between one-third and one-half as large. Impulsivity is relatively more important in understanding the decision to skip breakfast or purchase a meal away from home. For these outcomes, we cannot reject the hypothesis that their associations with impulsivity and restraint are equally strong. Low restraint and high impulsivity have a compounding effect in increasing the number of dinners purchased outside of the home. In all other cases, impulsivity and restraint have independent effects on eating habits.

4.2.3 Nutrition

Eating a healthy diet is an important part of maintaining a healthy weight. Increasing healthy food intake, such as vegetables, whole grains, and fruits, has been linked to weight loss, while an increase in the consumption of poor food choices, such as chips, processed meats, sweets, and dessert has been associated with weight gain (Mozaffarian et al., 2011). It seems reasonable to expect that people's capacity for self-control influences the types of food they eat. We investigate this using nutritional information to shed light on the role of self-control in both healthy and unhealthy food intake. In particular, we capture healthy nutrition through indicators of whether people eat vegetables and fruit every day as well as the total number of servings of each they consume each week. Unhealthy food intake is measured through indicators of whether people eat fried food, processed meat, sweets (e.g., cake, ice cream, or other desserts), and snack food more than once a week.

People's overall level of self-control is associated with the nutritional value of the foods they eat. Those with limited self-control are less likely to eat vegetables (2.8 pp.) and fruits (8.0 pp.) every day and, overall, eat at least one serving less of both vegetables and fruits each week (see Table 8, Panel A). In contrast, they are substantially more likely to consume unhealthy foods. Having limited self-control is associated with a 39.8 percent (7.0 pp.) increase in the weekly consumption of fried food. There is also a 11 to 18 percent increase in the frequent consumption of (i) processed meat products (4.4 pp.); (ii) sweets such as confectionery, ice cream, cake, biscuits, dessert, or pastries (5.8 pp.); and (iii) snack foods (5.7 pp.). Self-control is unrelated only to the type of milk (i.e., low fat vs. full-cream) consumed by people choosing cows' milk rather than plant-based milk.

The predictive power of self-control is larger for inhibiting unhealthy foods than it is for promoting healthy food intake. Our results indicate that self-control is associated with an 11 to 40 percent disparity in unhealthy food consumption, but only a 5 to 18 percent disparity in the consumption of healthy foods. Adriaanse et al. (2014) find similar results in a small sample of (mainly) female undergraduate students.

Impulsivity and restraint both shape the overall nutrition level of the food people consume (see Table 8, Panel B). Low restraint is more predictive of daily fruit consumption, while impulsivity is more strongly associated with regularly consuming fried or processed meat than is restraint. In the case of both fruit and vegetables, we find that people's restraint is more strongly associated with the incidence of daily consumption, whereas the number of weekly servings people consume is more strongly associated with their impulsivity. Although the differences are not always statistically significant, these patterns may reflect differences in the way that restraint and impulsivity are related to the extensive margin vs. intensive margin of food consumption. The choice to eat fruit and vegetables each day may be the result of positive habit formation (i.e., high restraint), while the overall consumption of healthy foods—and the avoidance of unhealthy foods—may be more about resisting temptation (i.e., low impulsivity).

Overall, people's level of impulsivity is as important as their capacity for restraint in the food choices they make. With only one exception (daily fruit consumption), the estimated effect of impulsivity is either significantly higher (processed meat consumption) than or statistically equivalent to that for restraint. At the same time, impulsivity and restraint seem to independently matter; the two facets of self-control do not have a compounding effect on people's food choices.

4.2.4 Discussion

Taken together, our results clearly indicate that the physiological mechanisms driving unhealthy weight are related to people's limited capacity for self-control. The nature of this relationship depends, however, on the specific mechanism we are considering and whether it is restraint or avoiding impulsive behavior that people find challenging. Physical activity and dieting, for example, are more closely linked to people's capacity for restraint than their degree of impulsivity, perhaps indicating that both require more planning and the ability to take deliberate action. Although the design of many weight loss programs and gym memberships is meant to support more controlled diet and exercise decisions, these programs often do not work as intended. There is high attrition and only modest weight loss associated with employer-sponsored wellness programs, for example (Cawley and Price, 2013). Many people pay substantial fees over long periods for gym memberships that they do not use (DellaVigna and Malmendier, 2006), yet the provision of modest financial incentives does not appear to help new gym members establish a habit of attending the gym more frequently (Carrera et al., 2018). In contrast, our results clearly suggest that a wide range of healthy lifestyle habits are closely linked to people's inherent capacity for restraint.

At the same time, impulsivity is at least, or in some cases, more important than restraint in understanding people's decisions about when, where, and what to eat. This is perhaps not surprising given that people's biological urge to eat may make their impulsivity more salient if they are faced with tempting choices. This makes impulsivity particularly relevant for the consumption of unhealthy food. In particular, food's taste attributes are more easily and quickly processed than are its health attributes (Liberman and Trope, 2008; Sullivan et al., 2015), making highly impulsive people, who act quickly, potentially more susceptible to poorer food choices. There is evidence, for example, that subjective ratings of impulsiveness and of perceived unhealthiness of 100 food categories are positively correlated (Thomas et al., 2012).

Moreover, higher trait self-control is associated with less intense visceral states (Baldwin et al., 2019). It is thus not surprising that, when making decisions about eating snack food (potato chips), people low in trait self-control are influenced more by their impulses than are those with a high level of trait self-control (Friese and Hofmann, 2009).

5 Conclusion

Across the globe, countries at all levels of development are facing challenges as their burden of disease shifts from communicable to non-communicable diseases (see Davies et al., 2014). Chronic diseases (e.g., heart disease, diabetes, cancer), in particular, are difficult to address because they are attributable to multiple factors, including people's lifestyle choices. This role of personal choice in shaping health outcomes has long been recognized by health economists and public health experts. Nearly half a century ago, Fuchs (1974) argued that "the greatest current potential for improving the health of the American people is to be found in what they do and don't do for themselves" (pp. 54-55).

Drawing on this insight, we analyze the behavioral origins of good health in an effort to understand why some people make healthier choices than others. Our focus on the relationship between self-control and unhealthy body weight is motivated by the observation that the globalization of unhealthy habits is a key force driving the worldwide spread of noncommunicable disease (Ferretti, 2015). Many of these habits (e.g., lack of physical activity, excess caloric intake, non-balanced diet) are linked to poor health outcomes through the role they have in increasing body weight.

Our contribution to the literature is, first, the use of population representative data which allows us to zero in on the population health consequences of low self-control. Those with limited self-control have an unhealthier body weight as well as poorer subjective weight-related well-being, suggesting that interventions to support people's self-control may have beneficial health consequences. Second, we propose an empirical method to use the well-established and widely used 13-item BSCS to differentiate between two core notions of self-control—restraint and impulsivity. We find that high impulsivity and low restraint have differential predictive power and are only modestly correlated. Differentiating between them adds predictive power and allows us to make progress in answering three important questions.

Who is most vulnerable to the negative weight consequences of limited self-control? Those struggling with low restraint are not necessarily the same people as those who are challenged by high impulsivity. We find, for example, that greater educational attainment is associated with less impulsivity, but there is only a modest relationship between education and restraint. Women are significantly more likely than men to lack restraint; yet they are significantly less likely to be highly impulsive. Given that unhealthy body weight is largely about low restraint rather than high impulsivity, it is possible that self-control limitations may be more consequential for the health of women. More generally, to the extent that some people simply have less capacity for self-control than others, the inability to self-regulate becomes a potential explanation for persisting health inequalities.[20]

Why is limited self-control related to unhealthy body weight? Differentiating between restraint and impulsivity allows us to relate our findings to those in psychology, neuroscience, health science, etc., most of which are founded on quite nuanced notions of what it means to be self-regulated. This has two consequences. First, we are able to draw more meaningful insights from our empirical results. Knowing, for example, that people process the taste and health attributes of food at different speeds helps us to understand why impulsivity and restraint are likely to manifest themselves differently in the consumption of healthy and unhealthy foods. Second, it focuses our attention on what we are measuring and the way that measurement may affect the conclusions that we draw. Questions of measurement are likely to become more critical as economists continue to make progress in incorporating self-control into their models of decision making. There is growing evidence, for example, that experimentally derived measures of present focus often fail to predict self-control problems, including obesity, in real life (see Delaney and Lades, 2017; Pastore et al., 2020). Even if existing self-control measures fail to predict the outcomes that we care about, it may nonetheless be premature to conclude that self-control itself does not matter; rather we may simply need other measures if we are to make progress.

How might policy interventions targeting self-control be used to improve population health? If the goal is weight reduction, improving weight-related subjective well-being, or increasing physical activity, then our results indicate that the policy focus should primarily be on increasing restraint rather than reducing impulsivity. Impulsivity is relatively more important

[20]See Bernheim et al. (2015) who make a similar argument with respect to self-control and poverty.

if we wish to influence when and where people eat or improve their nutrition levels. Given this, we may be able to improve dietary self-control through interventions that slow decision making down or speed up the processing of food's health attributes. One potential strategy for achieving this may be for policy to target the 'time price' of food consumption by increasing the time it takes to purchase and consume unhealthy food, while decreasing the time necessary for the purchase and consumption of healthy food (see Ruhm, 2012).

Despite these insights, there remain several important issues awaiting future research. The first relates to the relationship between impulsivity and restraint. Why, for example, is there an offsetting (rather than compounding) effect between high impulsivity and low restraint in the association with objective body weight measures? What does this mean in practice? Does it hold in other contexts? The second issue is around the importance of habits. If impulsivity and restraint affect the intensive vs. extensive margin of healthy food consumption in different ways, as our findings suggest, can this be explained by habit formation? More broadly, what is the role of habit formation in supporting people's capacity to make healthy choices? The third issue stems from unanswered conceptual questions about temptation (see Ericson and Laibson, 2019). Given the inherent links between impulsivity and temptation, is it possible to use a measure of impulsivity to discriminate between the types of decisions that do and do not involve temptation? Future research which addresses these—and other key questions—would be valuable in developing a deeper understanding of the underlying mechanisms that link self-control limitations to unhealthy body weight.

Finally, our research demonstrates the advantages of empirically distinguishing between conceptually different facets of self-control in understanding people's body weight, physical activity, dietary habits, and overall nutrition. The recent availability of the BSCS in large-scale, population representative panel surveys—and an empirical method to differentiate between impulsivity and restraint—offers an exciting opportunity to develop a deeper understanding of the role of self-control in numerous other life outcomes.

Tables and Figures

Table 1: Brief Self-Control Scale Questionnaire

Item	
1	I am good at resisting temptation (reversed)
2	I have a hard time breaking bad habits
3	I am lazy
4	I say inappropriate things
5	I do certain things that are bad for me, if they are fun
6	I refuse things that are bad for me (reversed)
7	I wish I had more self-discipline
8	People would say I have iron self-discipline (reversed)
9	Pleasure and fun sometimes keep me from getting work done
10	I have trouble concentrating
11	I can work effectively towards long-term goals (reversed)
12	Sometimes I cannot stop myself from doing something, even if I know it is wrong
13	I often act without thinking through all the alternatives

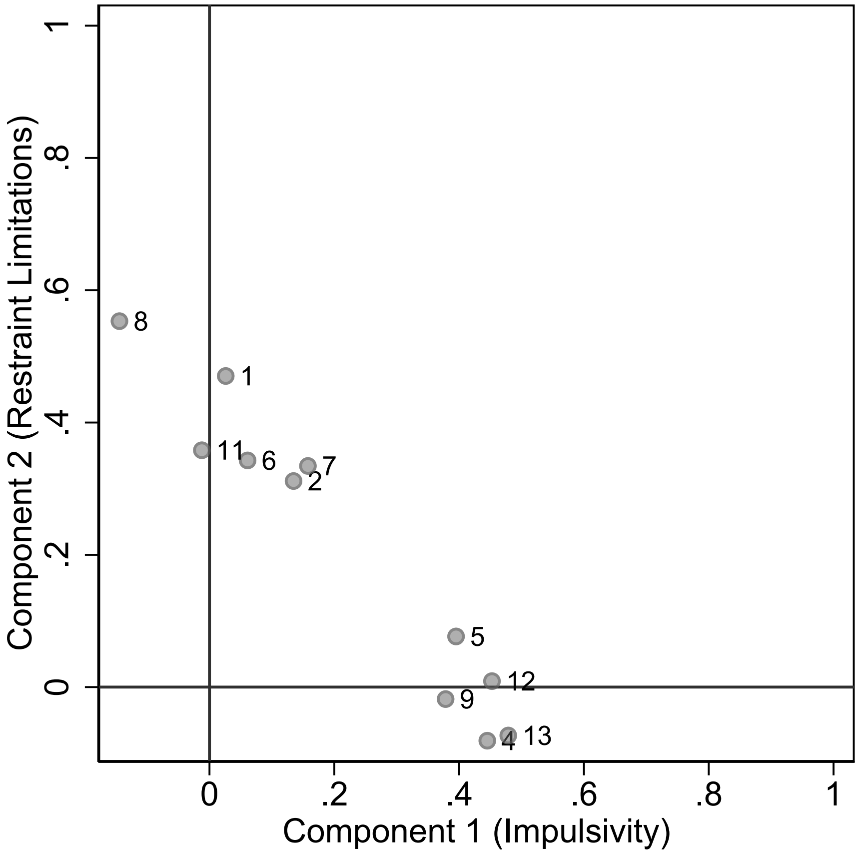
Note: HILDA questionnaire wave 2019 based on Tangney et al. (2004). The items are introduced by the question "How well do the following statements describe how you usually are?" with respondents answering on a scale from 1 ("not at all") to 5 ("very well"). The scale of questions marked as "reversed" are reversed, so that greater scores reflect increasing self-control limitations.

Table 2: Factor Loadings

Item		Impulsivity	Restraint Limitations
1	I am good at resisting temptation (reversed)	0.0260	**0.4704**
2	I have a hard time breaking bad habits	0.1347	**0.3115**
4	I say inappropriate things	**0.4452**	-0.0811
5	I do certain things that are bad for me, if they are fun	**0.3951**	0.0766
6	I refuse things that are bad for me (reversed)	0.0610	**0.3427**
7	I wish I had more self-discipline	0.1577	**0.3343**
8	People would say I have iron self-discipline (reversed)	-0.1443	**0.5532**
9	Pleasure and fun sometimes keep me from getting work done	**0.3784**	-0.0181
11	I can work effectively towards long-term goals (reversed)	-0.0123	**0.3581**
12	Sometimes I cannot stop myself from doing something, even if I know it is wrong	**0.4527**	0.0090
13	I often act without thinking through all the alternatives	**0.4788**	-0.0732

Note: HILDA analysis sample, 14,937 obs. Factor loadings from principal component analysis with orthogonal varimax rotation. Loadings with absolute value above 0.20 in bold.

Figure 1: Factor Loadings



Note: HILDA analysis sample, 14,937 obs. Factor loadings from principal component analysis with orthogonal varimax rotation.

Table 3: Correlation with Impulsivity as Measured by World Bank Motivational Traits

		Impulsivity based on	
		3 items	1 item
Individual Items			
1	I am good at resisting temptation (reversed)	0.223	0.179
2	I have a hard time breaking bad habits	0.180	0.139
3	I am lazy	0.210	0.154
4	*I say inappropriate things*	0.319	0.231
5	*I do certain things that are bad for me, if they are fun*	0.250	0.234
6	I refuse things that are bad for me (reversed)	0.173	0.146
7	I wish I had more self-discipline	0.207	0.152
8	People would say I have iron self-discipline (reversed)	0.140	0.101
9	*Pleasure and fun sometimes keep me from getting work done*	0.229	0.184
10	I have trouble concentrating	0.276	0.198
11	I can work effectively towards long-term goals (reversed)	0.201	0.127
12	*Sometimes I cannot stop myself from doing something, even if I know it is wrong*	0.280	0.218
13	*I often act without thinking through all the alternatives*	0.393	0.271
Continuous Aggregate Measures			
Self-Control Limitations (Continuous)		0.407	0.309
Impulsivity (Continuous)		0.419	0.323
Restraint Limitations (Continuous)		0.262	0.200
Indicators for Aggregate Measures			
Limited Self-Control (Dummy)		0.288	0.217
High Impulsivity (Dummy)		0.318	0.240
Low Restraint (Dummy)		0.171	0.131

Note: HILDA analysis sample, 14,937 obs. Individual items loading on impulsivity in italics. Pearson's correlation coefficients of each item and each aggregate measure with alternative impulsivity measure. Alternative impulsivity is measured as part of the motivational traits elicited through the World Bank Survey of Financial Capability (Kempson et al., 2013; Wilkins and Lass, 2018), based either on the average of three items ("I do things without giving them much thought", "I am impulsive", and "I say things before I have thought them through") or on the single most direct item ("I am impulsive"), each answered on a scale from 1 ("strongly disagree") to 7 ("strongly agree").

Table 4: Self-Control and Objective Weight Measures

	Outcome variable						
	Weight	BMI	Over-weight	Obese	Waist circum-ference	Waist/height ratio	WH ratio ≥ 0.5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Self-Control							
Limited Self-Control	4.218***	1.431***	0.085***	0.084***	4.183***	0.024***	0.094***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Adj. R^2	0.186	0.089	0.091	0.058	0.176	0.158	0.152
Obs.	14,937	14,937	14,937	14,937	11,995	11,857	11,857
Panel B: Impulsivity and Restraint							
High Impulsivity	1.942***	0.657***	0.031***	0.036***	2.121***	0.013***	0.047***
	(0.000)	(0.000)	(0.008)	(0.001)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.011]	[0.002]	[0.001]	[0.001]	[0.001]
Low Restraint	5.418***	1.896***	0.122***	0.122***	4.745***	0.028***	0.108***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
High Imp.*Low Restr.	-1.299*	-0.578**	-0.038**	-0.042**	-1.124*	-0.008**	-0.036*
	(0.070)	(0.015)	(0.048)	(0.016)	(0.092)	(0.039)	(0.070)
	[0.211]	[0.097]	[0.175]	[0.097]	[0.211]	[0.170]	[0.211]
High Imp.=Low Restr.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Adj. R^2	0.193	0.097	0.096	0.064	0.184	0.166	0.156
Obs.	14,937	14,937	14,937	14,937	11,995	11,857	11,857

Note: HILDA analysis sample, OLS regressions. In addition, female, Aboriginal status, immigration background, marital status, education, parental education, household income, and a maximum set of age dummies, state dummies, and a constant are controlled for. Row 'High Imp.=Low Restr.' in panel B indicates p-value corresponding to test of coefficient equality between High Impulsivity and Low Restraint. Conventional p-values in parentheses; Romano-Wolf p-values adjusted for multiple hypothesis testing within each panel in brackets. *p<0.1, **p<0.05, ***p<0.01 based on conventional p-values.

Table 5: Self-Control and Weight-Related Well-Being

	Outcome variable			
	Satisfaction with weight	Self-rated overweight	Ideal weight	Difference to ideal weight
	(1)	(2)	(3)	(4)
Panel A: Self-Control				
Limited Self-Control	-0.395***	0.161***	1.319***	2.890***
	(0.000)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.001]
Adj. R^2	0.089	0.079	0.350	0.089
Obs.	13,105	13,107	14,811	14,811
Panel B: Impulsivity and Restraint				
High Impulsivity	-0.158***	0.074***	0.962***	1.081***
	(0.000)	(0.000)	(0.001)	(0.000)
	[0.001]	[0.001]	[0.003]	[0.001]
Low Restraint	-0.434***	0.182***	2.202***	3.256***
	(0.000)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.001]
High Impulsivity*Low Restraint	0.065	-0.029	-0.906*	-0.607
	(0.122)	(0.174)	(0.067)	(0.112)
	[0.309]	[0.309]	[0.271]	[0.309]
High Impulsivity=Low Restraint	0.000	0.000	0.001	0.000
Adj. R^2	0.104	0.091	0.353	0.097
Obs.	13,105	13,107	14,811	14,811

Note: HILDA analysis sample, OLS regressions. In addition, female, Aboriginal status, immigration background, marital status, education, parental education, household income, and a maximum set of age dummies, state dummies, and a constant are controlled for. Row 'High Impulsivity=Low Restraint' in panel B indicates p-value corresponding to test of coefficient equality between High Impulsivity and Low Restraint. Conventional p-values in parentheses; Romano-Wolf p-values adjusted for multiple hypothesis testing within each panel in brackets. *p<0.1, **p<0.05, ***p<0.01 based on conventional p-values.

Table 6: Mechanisms—Exercise

	Outcome variable							
	Vigorous activity		Moderate activity		Walking			Total MET
	At all	Minutes	At all	Minutes	No. of days	Everyday	Minutes	Minutes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Self-Control								
Limited Self-Control	-0.061***	-28.580***	-0.039***	-17.168***	-0.197***	-0.038***	-28.965***	-392.299***
	(0.000)	(0.000)	(0.000)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.005]	[0.001]	[0.001]	[0.001]	[0.001]
Adj. R^2	0.126	0.084	0.031	0.046	0.036	0.019	0.025	0.084
Obs.	13,579	13,534	13,574	13,525	13,571	13,571	13,496	13,480
Panel B: Impulsivity and Restraint								
High Impulsivity	-0.022*	0.328	-0.010	1.853	-0.131*	-0.012	-18.201**	-49.837
	(0.081)	(0.952)	(0.445)	(0.793)	(0.058)	(0.350)	(0.027)	(0.476)
	[0.384]	[0.961]	[0.862]	[0.961]	[0.307]	[0.857]	[0.177]	[0.862]
Low Restraint	-0.057***	-19.371***	-0.044***	-6.587	-0.368***	-0.060***	-27.040***	-276.614***
	(0.000)	(0.000)	(0.000)	(0.342)	(0.000)	(0.000)	(0.001)	(0.000)
	[0.001]	[0.004]	[0.006]	[0.331]	[0.001]	[0.001]	[0.006]	[0.002]
High Impulsivity*Low Restraint	0.017	-7.102	0.000	-17.561	0.280**	0.028	21.688	-47.783
	(0.393)	(0.424)	(0.995)	(0.130)	(0.013)	(0.182)	(0.110)	(0.678)
	[0.803]	[0.803]	[0.994]	[0.517]	[0.085]	[0.580]	[0.490]	[0.882]
High Impulsivity=Low Restraint	0.024	0.004	0.036	0.346	0.007	0.003	0.399	0.011
Adj. R^2	0.126	0.083	0.031	0.046	0.038	0.020	0.025	0.083
Obs.	13,579	13,534	13,574	13,525	13,571	13,571	13,496	13,480

Note: HILDA analysis sample, OLS regressions. In addition, female, Aboriginal status, immigration background, marital status, education, parental education, household income, and a maximum set of age dummies, state dummies, and a constant are controlled for. Row 'High Impulsivity=Low Restraint' in panel B indicates p-value corresponding to test of coefficient equality between High Impulsivity and Low Restraint. Conventional p-values in parentheses; Romano-Wolf p-values adjusted for multiple hypothesis testing within each panel in brackets. *p<0.1, **p<0.05, ***p<0.01 based on conventional p-values.

Table 7: Mechanisms—Eating Habits

	Outcome variable					
	Diet to lose weight		Skip breakfast	No. of days purchase		
	Current	2+ last year	No. of days	Breakfast	Lunch	Dinner
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Self-Control						
Limited Self-Control	0.061***	0.091***	0.442***	0.066***	0.195***	0.127***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]
Adj. R^2	0.031	0.045	0.106	0.062	0.120	0.134
Obs.	13,073	13,083	13,583	13,583	13,581	13,577
Panel B: Impulsivity and Restraint						
High Impulsivity	0.025**	0.048***	0.238***	0.075***	0.126***	0.037
	(0.014)	(0.000)	(0.000)	(0.001)	(0.001)	(0.137)
	[0.030]	[0.001]	[0.001]	[0.007]	[0.007]	[0.132]
Low Restraint	0.079***	0.093***	0.231***	0.048**	0.155***	0.046*
	(0.000)	(0.000)	(0.000)	(0.025)	(0.000)	(0.062)
	[0.001]	[0.001]	[0.001]	[0.051]	[0.001]	[0.065]
High Impulsivity*Low Restraint	-0.016	-0.021	0.135	0.011	-0.011	0.112***
	(0.328)	(0.236)	(0.179)	(0.757)	(0.853)	(0.006)
	[0.761]	[0.719]	[0.705]	[0.954]	[0.954]	[0.068]
High Impulsivity=Low Restraint	0.000	0.001	0.937	0.332	0.542	0.786
Adj. R^2	0.035	0.049	0.107	0.064	0.121	0.135
Obs.	13,073	13,083	13,583	13,583	13,581	13,577

Note: HILDA analysis sample, OLS regressions. In addition, female, Aboriginal status, immigration background, marital status, education, parental education, household income, and a maximum set of age dummies, state dummies, and a constant are controlled for. Row 'High Impulsivity=Low Restraint' in panel B indicates p-value corresponding to test of coefficient equality between High Impulsivity and Low Restraint. Conventional p-values in parentheses; Romano-Wolf p-values adjusted for multiple hypothesis testing within each panel in brackets. *p<0.1, **p<0.05, ***p<0.01 based on conventional p-values.

Table 8: Mechanisms—Nutrition

	Outcome variable								
	Milk	Vegetables		Fruits		More than once a week			
	Low fat	Everyday	Servings	Everyday	Servings	Fried	Processed meat	Sweets	Snacks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Self-Control									
Limited Self-Control	0.002	-0.028***	-1.024***	-0.080***	-1.067***	0.070***	0.044***	0.058***	0.057***
	(0.884)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.881]	[0.014]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Adj. R^2	0.073	0.082	0.078	0.093	0.045	0.058	0.059	0.055	0.060
Obs.	11,422	13,586	13,508	13,585	12,636	14,937	14,937	14,937	14,937
Panel B: Impulsivity and Restraint									
High Impulsivity	-0.002	-0.028**	-0.941***	-0.027**	-0.596***	0.055***	0.057***	0.019	0.026**
	(0.877)	(0.026)	(0.000)	(0.031)	(0.004)	(0.000)	(0.000)	(0.128)	(0.023)
	[0.861]	[0.099]	[0.001]	[0.099]	[0.019]	[0.001]	[0.001]	[0.245]	[0.099]
Low Restraint	0.014	-0.039***	-0.629***	-0.059***	-0.906***	0.036***	0.031***	0.046***	0.047***
	(0.303)	(0.002)	(0.007)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)
	[0.306]	[0.005]	[0.012]	[0.001]	[0.001]	[0.001]	[0.012]	[0.001]	[0.001]
High Impulsivity*Low Restraint	-0.016	0.021	0.372	-0.026	0.070	-0.000	-0.013	0.009	0.016
	(0.470)	(0.324)	(0.339)	(0.215)	(0.836)	(0.995)	(0.488)	(0.659)	(0.405)
	[0.961]	[0.937]	[0.937]	[0.851]	[0.967]	[0.996]	[0.961]	[0.961]	[0.944]
High Impulsivity=Low Restraint	0.357	0.527	0.298	0.043	0.232	0.108	0.072	0.077	0.146
Adj. R^2	0.073	0.082	0.078	0.095	0.046	0.059	0.061	0.056	0.062
Obs.	11,422	13,586	13,508	13,585	12,636	14,937	14,937	14,937	14,937

Note: HILDA analysis sample, OLS regressions. In addition, female, Aboriginal status, immigration background, marital status, education, parental education, household income, and a maximum set of age dummies, state dummies, and a constant are controlled for. Row 'High Impulsivity=Low Restraint' in panel B indicates p-value corresponding to test of coefficient equality between High Impulsivity and Low Restraint. Conventional p-values in parentheses; Romano-Wolf p-values adjusted for multiple hypothesis testing within each panel in brackets. *$p<0.1$, **$p<0.05$, ***$p<0.01$ based on conventional p-values.

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Appendix

Table A.1: Variable Descriptions

Variable	Description
Self-Control	
Limited Self-Control	=1 if standardized trait self-control limitations measure based on 13-item BSCS (simple average of all 13 items) in top quartile; 0 otherwise
High Impulsivity	=1 if impulsivity measure derived from principal component analysis in top quartile; 0 otherwise
Low Restraint	=1 if restraint limitations measure derived from principal component analysis in top quartile; 0 otherwise
Weight Measures	
Weight	Current weight (in kg)
BMI	Body Mass Index; current weight divided by height (in m) squared
Overweight	=1 if BMI≥25; 0 otherwise
Obese	=1 if BMI≥30; 0 otherwise
Waist circumference	Waist circumference (in cm) in 2017
Waist/height ratio	Waist-to-height ratio in 2017
WH ratio≥0.5	=1 if waist-to-height ratio in 2017≥0.5; 0 otherwise
Satisfaction with weight	Standardized and reversed answer to "How satisfied are you with your current weight?" on scale from 1 (very satisfied) to 5 (very dissatisfied)
Self-rated overweight	=1 if self-rated as overweight; 0 otherwise
Ideal weight	Desired weight for 2020 (in kg)
Difference to ideal weight	Current weight minus ideal weight (in kg)
Mechanisms	
Vigorous activity: At all	=1 if engaged in vigorous physical activity in last seven days; 0 otherwise
Vigorous activity: Minutes	Total time spent in vigorous physical activity over last 7 days (in minutes)
Moderate activity: At all	=1 if engaged in vigorous physical activity in last seven days; 0 otherwise
Moderate activity: Minutes	Total time spent in moderate physical activity over last 7 days (in minutes)
Walking: No. of days	Number of days walked for at least 10 minutes in last 7 days
Walking: Everyday	=1 if walked for at least 10 minutes everyday in last 7 days, 0 otherwise
Walking: Minutes	Total time spent walking over last 7 days (in minutes)

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Total MET: Minutes	Total physical activity Metabolic Equivalent of Task (MET) per week (in minutes); MET summarizes walking, moderate, and vigorous activity, with one minute walking/moderate activity/vigorous activity entering the MET score with 3.3/4.0/8.0 minutes (see Wooden, 2014)
Diet to lose weight: Current	=1 if currently on a diet to lose weight; 0 otherwise
Diet to lose weight: 2+ last year	=1 if dieted in order to lose weight more than once in the last 12 months or always on a diet; 0 otherwise
Skip breakfast: No. of days	Number of days per usual week without eating some food for breakfast
No. of days purchase: Breakfast	Number of times in a usual week respondent purchases breakfast from an outlet
No. of days purchase: Lunch	Number of times in a usual week respondent purchases lunch from an outlet
No. of days purchase: Dinner	Number of times in a usual week respondent purchases dinner from an outlet
Milk: Low fat	=1 if main type of milk usually used low/reduced fat; 0 otherwise. Missing if respondent does not usually drink cow milk
Vegetables: Everyday	=1 if usually eating vegetables everyday; 0 otherwise
Vegetables: Servings	Usual number of serves of vegetables per week
Fruits: Everyday	=1 if usually eating fruits everyday; 0 otherwise
Fruits: Servings	Usual number of serves of fruit per week
More than once a week: Fried	=1 if usually eating fried potatoes, french fries, hot chips, or wedges twice a week or more often; 0 otherwise
More than once a week: Processed meat	=1 if usually eating processed meat products twice a week or more often; 0 otherwise
More than once a week: Sweets	=1 if usually eating confectionery, ice-cream, biscuits, cakes, pies, cake-type desserts, pastries, etc. twice a week or more often; 0 otherwise
More than once a week: Snacks	=1 if usually eating snack foods twice a week or more often; 0 otherwise
Control Variables	
Female	=1 if female; 0 otherwise
Age	Age in years (enters regressions through fixed effects)
State	Current state of residence (enters regressions through fixed effects)
Aboriginal status	=1 if Aboriginal and/or Torres Strait Islander; 0 otherwise
First-gen. immigration background	=1 if born outside of Australia; 0 otherwise
Second-gen. immigration background	=1 if born in Australia, but father or mother born outside of Australia; 0 otherwise

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Married	=1 if currently married or in de facto relationship; 0 otherwise
Never married	=1 if never married nor in de facto relationship; 0 otherwise
Education: Year 11	=1 if completed year 11 or below; 0 otherwise
Education: Year 12	=1 if completed year 12; 0 otherwise
Education: Certificate	=1 if completed certificate III or IV; 0 otherwise
Education: Diploma	=1 if completed (advanced) diploma; 0 otherwise
Education: Bachelor	=1 if completed bachelor or honours; 0 otherwise
Education: Graduate	=1 if completed graduate diploma or certificate; 0 otherwise
Education: Postgraduate	=1 if completed masters or doctorate; 0 otherwise
Father's education	=1 if father completed year 12 or equivalent; 0 otherwise
Mother's education	=1 if mother completed year 12 or equivalent; 0 otherwise
Household income: First quintile	=1 if equivalized household disposable income (in $1,000) is in bottom quintile; 0 otherwise
Household income: Second quintile	=1 if equivalized household disposable income (in $1,000) is in second quintile; 0 otherwise
Household income: Third quintile	=1 if equivalized household disposable income (in $1,000) is in third quintile; 0 otherwise
Household income: Fourth quintile	=1 if equivalized household disposable income (in $1,000) is in fourth quintile; 0 otherwise
Household income: Fifth quintile	=1 if equivalized household disposable income (in $1,000) is in top quintile; 0 otherwise

Note: HILDA version. Information is taken from 2019 except for waist circumference, waist/height ratio and all mechanism variables (taken from 2017).

Table A.2: Summary Statistics—Outcome Variables

Variable	Mean (1)	Std. Dev. (2)	Min. (3)	Max. (4)	Obs. (5)
Weight Measures					
Weight	79.893	19.363	30	200	14,937
BMI	27.339	6.056	11.668	74.609	14,937
Overweight	0.604	0.489	0	1	14,937
Obese	0.267	0.442	0	1	14,937
Waist circumference	93.586	15.772	34	185	11,995
Waist/height ratio	0.548	0.091	0.22	0.99	11,857
WH ratio≥0.5	0.698	0.459	0	1	11,857
Satisfaction with weight	-0.000	1.000	-1.673	1.825	13,105
Self-rated overweight	0.450	0.497	0	1	13,107
Ideal weight	73.555	14.844	30	180	14,811
Difference to ideal weight	6.355	9.690	-43	131	14,811
Mechanisms					
Vigorous activity: At all	0.458	0.498	0	1	13,579
Vigorous activity: Minutes	110.095	212.042	0	1,260	13,534
Moderate activity: At all	0.608	0.488	0	1	13,574
Moderate activity: Minutes	166.784	271.495	0	1,260	13,525
Walking: No. of days	4.175	2.637	0	7	13,571
Walking: Everyday	0.354	0.478	0	1	13,571
Walking: Minutes	244.949	313.535	0	1,260	13,496
Total MET: Minutes	2354.149	2740.648	0	19,278	13,480
Diet to lose weight: Current	0.180	0.384	0	1	13,073
Diet to lose weight: 2+ last year	0.215	0.411	0	1	13,083
Skip breakfast: No. of days	1.508	2.434	0	7	13,583
No. of days purchase: Breakfast	0.338	0.852	0	7	13,583
No. of days purchase: Lunch	1.188	1.496	0	7	13,581
No. of days purchase: Dinner	0.913	1.008	0	7	13,577
Milk: Low fat	0.400	0.490	0	1	11,422
Vegetables: Everyday	0.508	0.500	0	1	13,586
Vegetables: Servings	16.297	9.229	1	42	13,508
Fruits: Everyday	0.443	0.497	0	1	13,585
Fruits: Servings	10.162	7.526	1	42	12,636
More than once a week: Fried	0.176	0.381	0	1	14,937
More than once a week: Processed meat	0.300	0.458	0	1	14,937
More than once a week: Sweets	0.530	0.499	0	1	14,937
More than once a week: Snacks	0.323	0.468	0	1	14,937

Note: HILDA analysis sample, observations vary by outcome (see last column).

Table A.3: Summary Statistics—Control Variables

Variable	Mean (1)	Std. Dev. (2)	Min. (3)	Max. (4)
Female	0.524	0.499	0	1
Age	46.073	18.970	15	100
State: NSW	0.285	0.452	0	1
State: VIC	0.253	0.435	0	1
State: QLD	0.219	0.414	0	1
State: SA	0.089	0.285	0	1
State: WA	0.089	0.285	0	1
State: TAS	0.034	0.181	0	1
State: NT	0.008	0.090	0	1
State: ACT	0.022	0.148	0	1
Aboriginal status	0.028	0.166	0	1
First-gen. immigration background	0.201	0.401	0	1
Second-gen. immigration background	0.207	0.405	0	1
Married	0.648	0.478	0	1
Never married	0.224	0.417	0	1
Education: Year 11	0.226	0.418	0	1
Education: Year 12	0.151	0.358	0	1
Education: Certificate	0.233	0.423	0	1
Education: Diploma	0.100	0.300	0	1
Education: Bachelor	0.160	0.367	0	1
Education: Graduate	0.062	0.241	0	1
Education: Postgraduate	0.068	0.251	0	1
Father's education	0.313	0.464	0	1
Mother's education	0.336	0.472	0	1
Equivalized disposable household income (in $1,000)	58.653	38.188	0	535.551

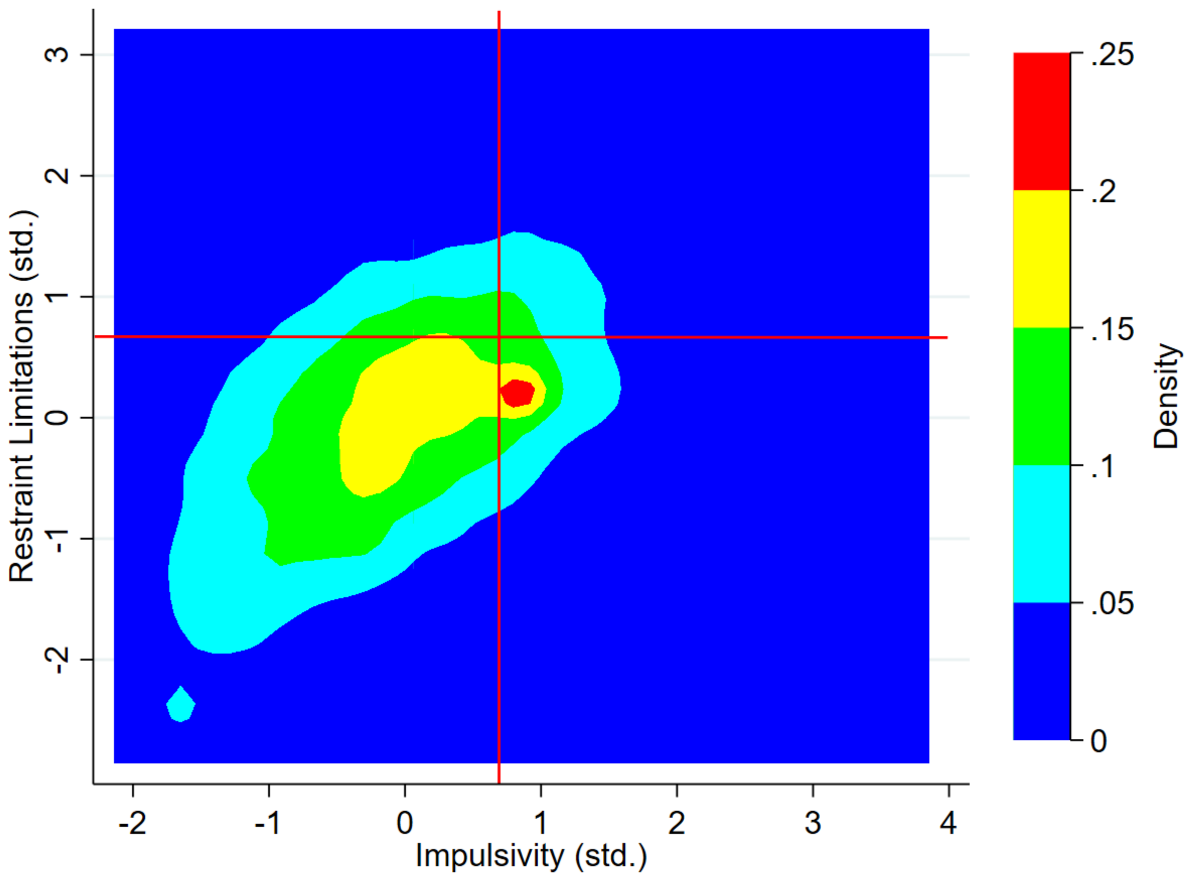
Note: HILDA analysis sample including all 14,937 observations.

Table A.4: Comparison of Full vs. Analysis Sample

Variable	Full sample		Analysis sample		Equality of means	
	Mean	Obs.	Mean	Obs.	t-stat.	p-value
	(1)	(2)	(3)	(4)	(5)	(6)
13-item BSCS score	2.534	15,463	2.532	14,937	0.294	0.769
Weight	79.769	15,724	79.893	14,937	-0.556	0.578
Height	170.706	15,626	170.791	14,937	-0.713	0.476
BMI	27.331	15,478	27.339	14,937	-0.109	0.913
Female	0.530	16,150	0.524	14,937	1.054	0.292
Age	46.156	16,150	46.073	14,937	0.383	0.702
State: NSW	0.287	16,150	0.285	14,937	0.363	0.717
State: VIC	0.253	16,150	0.253	14,937	-0.073	0.942
State: QLD	0.219	16,150	0.219	14,937	-0.173	0.863
State: SA	0.089	16,150	0.089	14,937	-0.022	0.982
State: WA	0.089	16,150	0.089	14,937	-0.038	0.969
State: TAS	0.034	16,150	0.034	14,937	0.270	0.787
State: NT	0.008	16,150	0.008	14,937	-0.421	0.674
State: ACT	0.022	16,150	0.022	14,937	-0.376	0.707
Aboriginal status	0.032	16,150	0.028	14,937	1.847	0.065
First-gen. immigration backgr.	0.201	16,123	0.201	14,937	-0.144	0.885
Second-gen. immigration backgr.	0.205	16,123	0.207	14,937	-0.382	0.703
Married	0.638	16,148	0.648	14,937	-1.836	0.066
Never married	0.230	16,148	0.224	14,937	1.294	0.196
Education: Year 11	0.240	16,141	0.226	14,937	2.967	0.003
Education: Year 12	0.150	16,141	0.151	14,937	-0.247	0.805
Education: Certificate	0.233	16,141	0.233	14,937	0.153	0.879
Education: Diploma	0.098	16,141	0.100	14,937	-0.684	0.494
Education: Bachelor	0.154	16,141	0.160	14,937	-1.575	0.115
Education: Graduate	0.060	16,141	0.062	14,937	-0.697	0.486
Education: Postgraduate	0.065	16,141	0.068	14,937	-1.156	0.248
Father's education	0.306	16,150	0.313	14,937	-1.357	0.175
Mother's education	0.328	16,150	0.336	14,937	-1.596	0.111
Equivalized disposable household income (in $1,000)	57.719	16,150	58.653	14,937	-2.166	0.030

Note: Columns 1 and 2: full sample of 16,150 HILDA survey participants responding to self-completion questionnaire in 2019; columns 3 and 4: HILDA analysis sample restricted to 14,937 survey participants with full information on BSCS, weight, height, and all control variables.

Figure A.1: Contour Plot of Bivariate Density



Note: HILDA analysis sample, 14,937 obs. Bivariate density plot of standardized measures of impulsivity and restraint limitations with Gaussian kernel; using `kdens2` ado-file. The correlation between the two continuous scores is 0.502. Red lines indicate the split at the top 25^{th} percentile for each score that is used to classify the corresponding indicators for high impulsivity and for low restraint; with 9,189 individuals having low impulsivity/high restraint (bottom left), 2,014 high impulsivity/high restraint (bottom right), 2,014 low impulsivity/low restraint (top left), and 1,720 high impulsivity/low restraint (top right). The tetrachoric correlation between the two indicators is 0.462.

Table A.5: Summary Statistics by Type

Variable	Sample by Impulsivity			Sample by Restraint		
	Mean		Equality of means	Mean		Equality of means
	Low (1)	High (2)	*p*-value (3)	High (4)	Low (5)	*p*-value (6)
Female	0.551	0.443	0.000	0.513	0.557	0.000
Age	47.807	40.870	0.000	47.841	40.766	0.000
State: NSW	0.291	0.267	0.005	0.287	0.279	0.297
State: VIC	0.254	0.251	0.747	0.253	0.253	0.950
State: QLD	0.215	0.233	0.023	0.218	0.224	0.443
State: SA	0.088	0.092	0.425	0.087	0.095	0.127
State: WA	0.088	0.091	0.572	0.089	0.088	0.818
State: TAS	0.033	0.037	0.150	0.034	0.033	0.657
State: NT	0.009	0.006	0.188	0.008	0.008	0.874
State: ACT	0.023	0.021	0.655	0.023	0.021	0.407
Aboriginal status	0.024	0.041	0.000	0.026	0.035	0.005
First-gen. immigration backgr.	0.212	0.169	0.000	0.222	0.137	0.000
Second-gen. immigration backgr.	0.201	0.225	0.002	0.200	0.226	0.001
Married	0.674	0.568	0.000	0.660	0.610	0.000
Never married	0.192	0.319	0.000	0.201	0.291	0.000
Education: Year 11	0.215	0.258	0.000	0.230	0.213	0.028
Education: Year 12	0.141	0.181	0.000	0.138	0.190	0.000
Education: Certificate	0.226	0.253	0.001	0.236	0.224	0.129
Education: Diploma	0.104	0.087	0.002	0.101	0.096	0.396
Education: Bachelor	0.171	0.128	0.000	0.160	0.161	0.815
Education: Graduate	0.067	0.046	0.000	0.063	0.058	0.299
Education: Postgraduate	0.074	0.048	0.000	0.071	0.057	0.003
Father's education	0.308	0.329	0.016	0.301	0.350	0.000
Mother's education	0.328	0.362	0.000	0.320	0.385	0.000
Equivalized disposable household income (in $1,000)	59.512	56.076	0.000	58.719	58.456	0.716
Observations	11,203	3,734		11,203	3,734	

Note: HILDA analysis sample including all 14,937 observations. Columns 1 and 2 display the average characteristics among those low (column 1) and high (column 2) in impulsivity, with column 3 indicating the *p*-values corresponding to a test for their equality. Columns 4 and 5 display the average characteristics among those high (column 4) and low (column 5) in restraint, with column 6 indicating the *p*-values corresponding to a test for their equality.