Differential Effects of Reward Drive and Rash Impulsivity on the Consumption of a Range of Hedonic Stimuli

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Background and aims: Impulsivity has consistently been associated with over-consumption and addiction. Recent research has reconceptualized impulsivity as a two-dimensional construct (Dawe, Gullo, & Loxton, 2004). This study explores the relationship of the two components of impulsivity, reward drive (RD) and rash impulsivity (RI), on a broad group of 23 hedonic consumption behaviors (e.g., gambling, substance use, eating, and media use). We tentatively grouped the behaviors into three descriptive classes: entertainment, foodstuffs, and illicit activities and substances. Results: RD and RI positively predicted elevated levels of consumption in a community sample (N = 5,391; 51% female), for the vast majority of the behaviors considered. However, the effect sizes for RD and RI varied significantly depending on the behavior; a pattern that appeared to be at least partially attributable to the class of consumption. Results support the view that RD is related more strongly to the consumption of products that provide social engagement or a sense of increased status; whereas RI better reflects an approach toward illicit or restricted products that are intensely rewarding with clear negative consequences. Discussion and conclusion: Results support the utility of the two-factor model of impulsivity in explaining individual differences in patterns of hedonic consumption in the general population. We discuss findings in terms of strengthening current conceptualizations of RI and RD as having distinct implications with respect to health-related behaviors.

Keywords: reward drive, rash impulsivity, consumption, health behavior, hedonic stimuli

INTRODUCTION

Research into health behavior and addiction has explored a broad range of hedonic products that tend to elicit excessive consumption that can lead to harm. These typically include products, such as foods (Davis & Carter, 2009), illicit substances (Darke, Kaye, McKetin, & Duflou, 2008; McGlothlin & West, 1968; Rehm, 2011), and retail goods (Sansone, Chang, Jewell, & Sellbom, 2012). More recently, the use of certain entertainment and media products has been considered as forms of consumption behavior (Noor, Rossier, & Erickson, 2014; Rockloff, 2011; Ward & Carlson, 2013), with much research now focusing on excessive or problematic use of digital media and gambling products (Morahan-Martín, 2005; Pentz, Spruill-Metz, Chou, & Riggs, 2011; Rockloff, 2011; Takao, Takahashi, & Kitamura, 2009). Impulsivity is consistently associated with excessive and unhealthy levels of various forms of consumption. Examples include food (Kane, Loxton, Staiger, & Dawe, 2004; Moreno-López, Soriano-Mas, Delgado-Rico, Rio-Valle, & Verdejo-García, 2012), substances (Petry, 2001), gambling products (Benson, Norman, & Griffiths, 2011; MacLaren, Fugelsang, Harrigan, & Dixon, 2012; Petry, 2001), retail goods (Billieux, Rochat, Rebetez, & Van der Linden, 2008), and digital media (Billieux, Van der Linden, & Rochat, 2008; Dong, Huang, & Du, 2011).

Impulsivity, broadly defined, reflects a tendency to engage in behavior in a rash manner that lacks foresight, reflection, or long-term planning. However, varied measures of impulsivity (derived from different theoretical backgrounds) have been applied across previous studies of personality (Dawe, Gullo, & Loxton, 2004). For example, Gray (1970, 1981) defined the construct in terms of individual differences in sensitivity and approach to reward, whereas other definitions of impulsivity describe rash unplanned behavior, risk taking, and novelty seeking (Cloninger, 1987; Eysenck & Eysenck, 1991; Zuckerman, Eysenck, & Eysenck, 1978). Whiteside & Lyman (2001) described a multi-factor model of impulsivity based on the factor analysis of self-report questionnaire data. Factors include urgency, lack of premeditation, lack of perseverance, and sensation seeking (UPPS; Whiteside & Lyman, 2001). More recently, conceptualizations of impulsivity, particularly as related to addictive behaviors, have focused on two distinct dimensions based on separate neural processes (Dawe & Loxton, 2004; Gullo, Loxton, & Dawe, 2014) and recent factor analytic studies suggest that impulsivity is likely to be a multi-dimensional construct, consisting of at least two correlated factors (Dawe et al., 2004). While both conceptualizations share similarities, it has been demonstrated that the two-factor model is the more parsimonious approach for understanding addictive behaviors (see Gullo et al., 2014).

In the two-factor model, the first factor is termed rash impulsivity (RI); involving difficulty inhibiting one’s behavior following the activation of an approach response, 

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consumption and Impulsivity

despite potential negative consequences and the second is reward drive (RD); the tendency for one to initiate goal-directed approach behavior in response to signals of reward. RD is thought to involve the mesolimbic dopaminergic pathways; a brain region associated with natural reinforcement responses to nutrients and reproduction. It is thought that RI reflects activity in the orbitofrontal cortex and the ventromedial prefrontal cortex; areas associated with self-control and decision making (Dawe et al., 2004).

RI and RD share many common features, including a positive relationship with addictive and hedonic behaviors (Dawe & Loxton, 2004; Dawe et al., 2004; Dissabandara et al., 2014; Gullo et al., 2014). Nevertheless, conceptually they describe complementary aspects of impulsivity relating to heightened approach (RD) and decreased inhibition (RI). RD is distinguished from RI in that high RD individuals report greater psychological well-being and hope, experiencing greater sociability and less loneliness – with RI being associated with less positive outcomes (Carver & White 1994; Clark, Loxton, & Tobin, 2015; Harnett, Loxton, & Jackson, 2013).

Only a few studies have taken the two-factor approach to measuring impulsivity; justifying the need for assessment of the unique roles of RD and RI in potentially determining consumption behavior of both addictive and non-addictive products. When entered simultaneously in regression models, both RI and RD explain unique variance in gambling, alcohol use, and drug use, although RI appears to be the stronger predictor of the two (Gullo, Ward, Dawe, Powell, & Jackson, 2011; Loxton, Nguyen, Casey, & Dawe, 2008; MacLaren et al., 2012). Studies linking impulsivity to addictive behavior have mainly aimed to predict clinical levels of only one or two specific behaviors, focusing on addictive substances and problematic behaviors. For example, Dissabandara et al. (2014) compared the levels of RD and RI between heroin-dependent subjects (n = 293) and non-users (n = 232), and Guerrieri, Nederkoorn, and Jansen (2008) assessed reward sensitivity, response inhibition, and food intake in normal versus obese children. To date, a few research studies have focused on subclinical levels of consumption in the general population. Thus, while RD and RI have been shown to play unique roles in the susceptibility to clinical levels of addictive behavior, it remains an open question as to whether these results apply to subclinical levels of overconsumption in the general population. In addressing this question, we are able to better understand the effect of impulsivity on minor levels of overconsumption that affect a substantial proportion of the general population (Sussman, Lisha, & Griffiths 2011). In addition, although theoretical conceptualizations of RD and RI imply differing relationships to qualitatively different types of behavior (e.g., social engagement vs. risk taking), these predictions have hitherto not been specifically tested. More generally, as little is known regarding the role of RD and RI in determining (mal)adaptive or (un)healthy patterns of consumption in the general population.

Current study

This paper considers RD and RI with respect to the day-to-day consumption of a wide range of hedonic products in a community sample. We focus on elevated usage levels in the general population, rather than discriminating clinical versus non-clinical levels. To concisely describe our predictions and findings regarding this wide range of variables, we group products into three tentative classes: foodstuffs, “illicit” activities including stigmatized or restricted/risky behaviors, as well as “entertainment” – a product category of modern media and economic consumption. Table 1 summarizes the measured items. Although products were categorized in this way for descriptive purposes only, a confirmatory factor analysis showed that item loadings were positive and, for the most part, homogeneous on their allocated factors. An RMSEA of .065 [95% CI .063, .066] suggested that this model fitted the data well.

Since general impulsivity is associated with various forms of hedonic consumption (Benson et al., 2011; Billieux et al., 2008; Dong et al., 2011; Kane et al., 2004; MacLaren et al., 2012; Moreno-López et al., 2012; Petry, 2001), we expect that RD and RI should be associated with above-average consumption of all behaviors listed in Table 1. According to the current conceptualization of the two-factor model, trait RD reflects goal-directed approach behavior (Dawe et al., 2004) and is associated with higher sociability and psychological well-being (Clark et al., 2015; Harnett et al., 2013). On the other hand, RI more likely reflects a lack of control (Dawe et al., 2004) and is associated with higher consumption of products providing intense reward with clear negative consequences (Gullo et al., 2011; Loxton et al., 2008; MacLaren et al., 2012). Therefore, we expect that RD will have a stronger association with the consumption of products classed as entertainment, which includes a range of activities that provide reward through experiences of social interaction; or increased social status via acquisition of wealth or assets. Notably, the behaviors in the entertainment category tend to involve some level of social or economic engagement and are either socially accepted or even encouraged. RI, on the other hand, should show stronger associations with the more intensely rewarding and potentially more dangerous products in the “illicit” category. These are products that are widely recognized to provide short-term rewards at the expense of potential long-term harms and should therefore be related to a lack of control and planning. It is less clear whether RD or RI is more important in explaining variability in food consumption. Although many experience a lack of control and long-term harms from excessive eating, foods tend to provide only moderately intense short-term rewards. Also, food

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**Table 1. Product classifications based on reward characteristics**

| Entertainment | Foods | Illicit |
|---------------|-------|---------|
| SMS           | Desserts | Pornography |
| Browsing online | Sweets | Alcohol |
| Magazines     | Snacks | Gambling |
| Brochures     | Caffeine | Smoking |
| Social networking | Soft drink | Drugs |
| Shopping      | Take away | |
| Internet      | Packaged food | |
| TV            | Salt | |
| Video gaming  | Meat products | |
consumption tends to have a strong social component (e.g., dining with family or having coffee with friends) and tends not to be socially proscribed. Therefore, we expect that both RD and RI may play a relatively equal role in predicting above-average food consumption.

METHODS

Survey participants and procedure

Data for this study were collected as part of a large research project, results involving the consumption items and the RD and RI variables have been published previously in separate manuscripts (Goodwin, Browne, & Rockloff, 2015; Goodwin, Browne, Rockloff, & Lexton, 2016, respectively). Participants consisted of 5,391 (51% female) members of an online survey panel maintained by an agency specializing in the recruitment of survey participants (myopinions.com.au). Participation was remunerated with credit points that could be accumulated and exchanged with the agency for cash. The survey took approximately 20 min to complete. Ages ranged from 18 to 87 years old ($M = 49.01$, $SD = 16.50$). Participants were born in Australia (74%), the United Kingdom (8.4%), New Zealand (2.7%), and other countries (14.9%).

Measures

Behavioral items. Behavioral items represented the consumption of a range of hedonic stimuli including energy dense foods and beverages, illicit and/or restricted substances, and various retail and/or media. The brief AUDIT C (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) and the Consumption Scale for Problem Gambling (CSPG; Rockloff, 2011) were utilized as validated measures of alcohol and gambling consumption. A further 21 variables were aggregated from a set of 31 additional novel items. Table A1 details each of the items that were summed to create each variable. Items were recorded on Likert scales (see Table A1 in Appendix), whereby the middle category represented an approximate average based on, where available, population norms (Goodwin et al., 2015). The behavioral variables were converted into binary indicators of “above typical consumption” based on a median split. While this transform results in some loss of information and power, it provided for an identical scale across all responses and enabled the use of a consistent analysis (logistic regression) in all cases, facilitating comparisons of effects across behaviors.

Rash impulsivity. RI was measured using a short version of the Barratt Impulsivity Scale (BIS-11; Spinella, 2007). This measure consists of 15 statements, whereby the participant must rate the extent to which the statement applies to them. Responses were recorded on a 4-point Likert scale (1, rarely/never; 2, occasionally; 3, often; and 4, almost always/always). This measure includes three subscales: (a) attentional (e.g., “I don’t pay attention”); (b) motor (e.g., “I act on the spur of the moment”); and (c) non-planning (e.g., “I am a careful thinker, [inverted]”). The total BIS-11 score was utilized in this study. Cronbach’s alpha in the present sample was .83.

Reward drive. The Behavioral Approach Scale (BAS) from the Behavioral Inhibition and Approach Scale (BIS/BAS; Carver & White, 1994) was used to measure RD. This 13-item measure involves three subscales: (a) drive, assessing a persistence in pursuing desired goals (e.g., “When I want something, I usually go all out to get it”), (b) reward responsiveness scale, focused on the response to occurrence or anticipation of reward (e.g., “When I’m doing well at something, I love to keep at it”), and (c) fun seeking (e.g., “I crave excitement and new sensations”). Responses were recorded on a 4-point Likert scale (1, rarely/never; 2, occasionally; 3, often; and 4, almost always/always). The total BAS score was utilized in this study. Cronbach’s alpha coefficient in this study was .88.

Statistical analysis

A series of multiple logistic regressions were performed with RD and RI predicting above-median consumption on each of the measured products. Each model controlled for gender, age, income, and the shared variance between RD and RI ($r = .27, p < .001$). A false discovery rate adjustment was applied to significance values to reduce the probability of a Type I error when running multiple analyses (Benjamini & Hochberg, 1995). The authors also ran another series of regressions, whereby each model included the interaction term, RD by RI. No significant interaction effects were found, therefore, only main effects are presented in the Results section.

Ethics

The study received Human Research Ethics Committee approval from the University’s Review Board and participants provided informed consent preceding the online survey.

RESULTS

Gender, age, and income effects

Table 2 compares gender, age, and income group means for each of the measured behaviors. Women were significantly higher consumers of many entertainment products; including TV, brochures, retail products, magazines, social networking, SMS, and online shopping products. Men consumed more of the illicit products along with some of the food items (e.g., pornography, cigarettes, alcohol, gambling products, drugs, caffeine, soft drink, meat products, take away food, and packaged food). Using a median split, those 51 years of age and under reported significantly higher consumption of most products, as did participants who earned over $65k per year. However, those earning $65k or under reported significantly more TV viewing, smoking of cigarettes, and reading of advertising brochures.

Regression of consumption behaviors on RD and RI

As shown in Table 3, RD significantly and positively predicted 19 of the 23 consumption behaviors, with the
### Table 2. Means, standard deviations, and t-tests for comparing gender, age, and income groups

|                    | Gender |           | Age       |           | Income       |           |
|--------------------|--------|-----------|-----------|-----------|--------------|-----------|
|                    | F      | M         | <51       | 51+       | <$65k        | $65k+     |
|                    | Mean   | (SD)      | Mean      | (SD)      | Mean         | (SD)      |
|                    |        |           |           |           |              |           |
| Packaged food      | 1.87   | (1.04)    | 2.02      | (1.17)    | 2.16          | (1.15)    |
|                    |        |           |           |           | 1.74          | (1.02)    |
|                    |        |           |           |           | 14.28***     |           |
| TV                 | 10.47  | (2.47)    | 10.31     | (2.60)    | 9.81          | (2.74)    |
|                    |        |           |           |           | 10.95         | (2.19)    |
|                    |        |           |           |           | -16.73***    |           |
| Smoking            | 1.59   | (1.53)    | 1.74      | (1.72)    | 1.68          | (1.59)    |
|                    |        |           |           |           | 1.65          | (1.66)    |
|                    |        |           |           |           | 0.75          |           |
| Soft drink         | 3.88   | (1.76)    | 4.29      | (1.83)    | 4.47          | (1.76)    |
|                    |        |           |           |           | 3.71          | (1.77)    |
|                    |        |           |           |           | 15.62***     |           |
| Internet           | 9.57   | (2.53)    | 9.91      | (2.48)    | 10.25         | (2.42)    |
|                    |        |           |           |           | 9.24          | (2.49)    |
|                    |        |           |           |           | 14.99***     |           |
| Meat products      | 2.54   | (0.97)    | 2.82      | (0.98)    | 2.81          | (1.06)    |
|                    |        |           |           |           | 2.55          | (0.88)    |
|                    |        |           |           |           | 9.91***       |           |
| Desserts           | 2.66   | (1.07)    | 2.61      | (1.02)    | 2.61          | (1.00)    |
|                    |        |           |           |           | 2.67          | (1.08)    |
|                    |        |           |           |           | -2.10*        |           |
| Brochures          | 3.34   | (1.41)    | 3.02      | (1.44)    | 3.03          | (1.42)    |
|                    |        |           |           |           | 3.32          | (1.43)    |
|                    |        |           |           |           | -7.49***      |           |
| Salt               | 4.86   | (1.70)    | 4.93      | (1.74)    | 4.92          | (1.66)    |
|                    |        |           |           |           | 4.87          | (1.78)    |
|                    |        |           |           |           | 1.00          |           |
| Sweets             | 3.00   | (1.21)    | 2.82      | (1.14)    | 3.00          | (1.17)    |
|                    |        |           |           |           | 2.83          | (1.19)    |
|                    |        |           |           |           | 5.17***       |           |
| Snacks             | 2.67   | (1.05)    | 2.67      | (1.03)    | 2.76          | (1.03)    |
|                    |        |           |           |           | 2.58          | (1.05)    |
|                    |        |           |           |           | 6.31***       |           |
| Video gaming       | 4.30   | (3.21)    | 4.85      | (3.52)    | 5.60          | (3.56)    |
|                    |        |           |           |           | 3.58          | (2.86)    |
|                    |        |           |           |           | 22.76***      |           |
| Take away          | 4.08   | (2.10)    | 4.30      | (2.15)    | 4.51          | (2.27)    |
|                    |        |           |           |           | 3.89          | (1.11)    |
|                    |        |           |           |           | 19.00***      |           |
| Shopping           | 4.58   | (1.38)    | 4.37      | (1.28)    | 4.68          | (1.43)    |
|                    |        |           |           |           | 4.29          | (1.21)    |
|                    |        |           |           |           | 10.72***      |           |
| Alcohol            | 2.71   | (2.15)    | 3.74      | (2.98)    | 3.28          | (2.90)    |
|                    |        |           |           |           | 3.14          | (2.74)    |
|                    |        |           |           |           | 1.80          |           |
| Magazines          | 1.83   | (1.09)    | 1.53      | (0.87)    | 1.62          | (0.92)    |
|                    |        |           |           |           | 1.75          | (1.06)    |
|                    |        |           |           |           | -4.48***      |           |
| Gambling           | 1.20   | (1.91)    | 1.78      | (2.47)    | 1.31          | (2.07)    |
|                    |        |           |           |           | 1.64          | (2.34)    |
|                    |        |           |           |           | -5.40***      |           |
| Drugs              | 1.08   | (0.46)    | 1.12      | (0.58)    | 1.16          | (0.66)    |
|                    |        |           |           |           | 1.04          | (0.35)    |
|                    |        |           |           |           | 8.41***       |           |
| Caffeine           | 19.34  | (4.54)    | 20.19     | (4.56)    | 19.64         | (5.18)    |
|                    |        |           |           |           | 19.85         | (3.89)    |
|                    |        |           |           |           | -1.70         |           |
| Pornography        | 2.44   | (1.45)    | 3.38      | (2.22)    | 3.27          | (2.20)    |
|                    |        |           |           |           | 2.53          | (1.53)    |
|                    |        |           |           |           | 14.06***      |           |
| Social network     | 10.99  | (5.99)    | 9.12      | (5.63)    | 12.38         | (5.84)    |
|                    |        |           |           |           | 7.95          | (5.08)    |
|                    |        |           |           |           | 29.38***      |           |
| SMS                | 3.32   | (1.16)    | 3.02      | (1.13)    | 3.65          | (1.08)    |
|                    |        |           |           |           | 2.73          | (1.04)    |
|                    |        |           |           |           | 31.82***      |           |
| Browse online      | 3.02   | (1.42)    | 2.85      | (1.35)    | 3.20          | (1.40)    |
|                    |        |           |           |           | 2.68          | (1.34)    |
|                    |        |           |           |           | 13.82***      |           |

Note: Age and income categories based on a median split.

*p < .05, **p < .01, ***p < .001.
Table 3. Logistic regression results predicting above-median consumption of a variety of products from reward drive (RD) and rash impulsivity (RI), controlling for gender, age, and income

| Product            | Range (median) | n > median | β (SE) | Wald | Lower CI | OR | Upper CI | β (SE) | Wald | Lower CI | OR | Upper CI |
|--------------------|----------------|------------|--------|------|----------|----|----------|--------|------|----------|----|----------|
| Packaged food      | 2–14 (2)       | 1,682      | -0.004 | 0.033| 0.110    | 0.971| 1.004    | 1.038  | 0.206| 0.033    | 6.326***| 1.189    | 1.229    | 1.270   |
| TV                 | 2–16 (10)      | 2,542      | 0.004  | 0.030| 0.143    | 0.974| 1.004    | 1.035  | 0.154| 0.030    | 5.213***| 1.133    | 1.167    | 1.202   |
| Soft drink         | 1–9 (1)        | 899        | 0.065  | 0.032| 2.138*   | 1.034| 1.067    | 1.101  | 0.159| 0.031    | 5.170***| 1.137    | 1.172    | 1.209   |
| Meat product       | 2–12 (4)       | 2,271      | 0.077  | 0.039| 1.945a   | 1.038| 1.080    | 1.123  | 0.095| 0.038    | 2.469*   | 1.058    | 1.099    | 1.143   |
| Internet           | 2–16 (10)      | 1,632      | 0.082  | 0.033| 2.477*   | 1.050| 1.086    | 1.123  | 0.153| 0.033    | 4.687***| 1.128    | 1.165    | 1.203   |
| Smoking            | 1–7 (3)        | 943        | 0.090  | 0.040| 2.252    | 1.051| 1.094    | 1.138  | 0.265| 0.039    | 6.757***| 1.253    | 1.304    | 1.356   |
| Desserts           | 1–7 (2)        | 2,494      | 0.100  | 0.030| 3.363**  | 1.073| 1.106    | 1.139  | 0.013| 0.029    | 0.449   | 0.984    | 1.013    | 1.043   |
| Junk mail          | 1–6 (3)        | 2,615      | 0.106  | 0.030| 3.495*** | 1.078| 1.111    | 1.145  | -0.080| 0.029    | -2.723**| 0.897    | 0.924    | 0.951   |
| Salt               | 2–8 (5)        | 2,115      | 0.114  | 0.030| 3.738*** | 1.088| 1.121    | 1.155  | 0.108| 0.030    | 3.671***| 1.082    | 1.115    | 1.148   |
| Snacks             | 1–7 (3)        | 1,451      | 0.116  | 0.030| 3.837*** | 1.089| 1.123    | 1.157  | 0.035| 0.029    | 1.188   | 1.005    | 1.035    | 1.066   |
| Sweets             | 1–7 (2)        | 2,618      | 0.123  | 0.034| 3.664*** | 1.093| 1.131    | 1.169  | 0.071| 0.033    | 2.168*   | 1.039    | 1.073    | 1.109   |
| Video gaming       | 2–16 (2)       | 2,466      | 0.133  | 0.032| 4.097*** | 1.106| 1.142    | 1.179  | 0.017| 0.031    | 5.540***| 0.986    | 1.018    | 1.050   |
| Magazines          | 2–14 (4)       | 1,576      | 0.152  | 0.031| 4.979*** | 1.129| 1.164    | 1.201  | 0.030| 0.030    | 1.016   | 1.000    | 1.030    | 1.061   |
| Take away          | 2–14 (4)       | 2,088      | 0.152  | 0.034| 4.498*** | 1.126| 1.165    | 1.205  | 0.190| 0.033    | 5.750***| 1.170    | 1.209    | 1.250   |
| Shopping           | 0–12 (3)       | 2,385      | 0.155  | 0.031| 4.911*** | 1.132| 1.168    | 1.205  | 0.061| 0.030    | 2.036a   | 1.032    | 1.063    | 1.096   |
| Alcohol            | 1–7 (1)        | 2,288      | 0.168  | 0.031| 5.388*** | 1.146| 1.183    | 1.220  | 0.235| 0.030    | 7.709***| 1.227    | 1.265    | 1.304   |
| Pornography        | 0–13 (1)       | 1,681      | 0.174  | 0.038| 4.592*** | 1.146| 1.191    | 1.237  | 0.176| 0.037    | 4.760***| 1.149    | 1.192    | 1.237   |
| Gambling           | 1–6 (3)        | 348        | 0.175  | 0.067| 4.833*** | 1.114| 1.191    | 1.274  | 0.283| 0.032    | 8.732***| 1.285    | 1.327    | 1.371   |
| Drugs              | 8–47 (20)      | 2,450      | 0.175  | 0.067| 2.613**  | 1.114| 1.191    | 1.274  | 0.512| 0.067    | 7.604***| 1.560    | 1.669    | 1.786   |
| Caffeine           | 2–16 (2)       | 1,371      | 0.178  | 0.031| 5.768*** | 1.158| 1.194    | 1.232  | 0.118| 0.030    | 3.958***| 1.093    | 1.126    | 1.160   |
| Social networking  | 3–25 (10)      | 2,548      | 0.213  | 0.033| 6.364*** | 1.197| 1.237    | 1.279  | 0.124| 0.032    | 3.863***| 1.097    | 1.133    | 1.170   |
| SMS                | 1–7 (3)        | 2,335      | 0.223  | 0.033| 6.663*** | 1.208| 1.249    | 1.292  | 0.095| 0.032    | 2.964**  | 1.065    | 1.100    | 1.136   |
| Browse online      | 1–6 (3)        | 1,676      | 0.238  | 0.033| 7.274*** | 1.228| 1.269    | 1.311  | -0.029| 0.032    | -0.934  | 0.941    | 0.971    | 1.002   |

Note. Variables sorted according to beta weight association with RD. SE: standard error; CI: confidence interval; OR: odds ratio.

*Marginal.

*p < .05, **p < .01, ***p < .001.
exception of smoking, buying packaged food, watching TV, and eating meat products (marginal). The strongest of these associations were between RD and frequency of: browsing online (standardized $\beta = .238$, $p < .001$), SMS ($\beta = .223$, $p < .001$), using social networking ($\beta = .213$, $p < .001$), viewing pornography ($\beta = .174$, $p < .001$), and consumption of caffeine ($\beta = .178$, $p < .001$). RI significantly and positively predicted 18 of the 23 consumption behaviors, with the exception of reading junk mail, eating desserts, shopping (marginal), reading magazines, and browsing online. The strongest of these associations were between RI and frequency of: using drugs ($\beta = .512$, $p < .001$), gambling ($\beta = .283$, $p < .001$), alcohol ($\beta = .235$, $p < .001$), buying packaged food ($\beta = .206$, $p < .001$), and eating take away food ($\beta = .190$, $p < .001$). Finally, the binarized behavioral responses were aggregated using a simple count; yielding a variable that described the number of behaviors (out of 23) that individuals undertook at above-median levels. Using ordinary least squares regression, this “total consumption” variable was predicted positively by both RD ($\beta = .645$, $p < .001$) and RI ($\beta = .604$, $p < .001$).

Figure 1 plots the standardized beta weights for RI and RD for each behavioral item. Items are coded according to Table 1 as entertainment, foods, or illicit, representing the three classes of stimuli measured. Items with asterisks above the dotted diagonal line (i.e., browsing online, brochures, magazines, snacks, desserts, shopping, SMS, and social networking) share significantly stronger associations with RD when compared to RI according to Fisher’s exact test for comparing parameter estimates, and those below the line (i.e., Internet, soft drink, TV, packaged foods, alcohol, gambling, smoking, and drugs) share significantly stronger association with RI.

**DISCUSSION**

The key study aim was to understand the relationship between the dimensions of the two-factor model of impulsivity and hedonic product consumption. In particular, we were interested in the differential effects of RD and RI on the consumption of a wide range of qualitatively different products. RD and RI were both positively associated with above-average consumption of almost all of the measured behavioral items. As expected, RI shared its strongest associations with the intensely rewarding and potentially dangerous products classified as illicit (e.g., alcohol, drugs, and gambling products). Both RD and RI tended to share small to moderate associations with food items, while RD shared its strongest associations with the consumption of products classed by the current authors as entertainment.

In accordance with the previous findings on clinical samples, people high in RI and RD reported higher levels of consumption. Thus, RD and RI appear to be not only useful in predicting addictive or disordered behaviors (Dissabandara et al., 2014; Kane et al., 2004; Loxton et al., 2008), but also in explaining elevated consumption in the general population. Nevertheless, with the exception of illicit drugs, the effect sizes for RI and RD tended to small to moderate. This is not especially surprising, since like

![Figure 1. Scatterplot of rash impulsivity (RI) and reward drive (RD) standardized beta weights from regression analyses for each behavioral item, *difference between RD and RI beta weight significant at $p < .05$](image-url)
other high-level personality constructs, RD and RI can be understood to have a “diffuse” effect on behavior; i.e., they have a small but measurable influence across a broad domain of specific behaviors. Given that unhealthy lifestyle choices are known to co-occur (be comorbid) in individuals, we have grounds to suspect that personality traits such as RD and RI are instrumental in explaining these multivariate comorbidities. While impulsivity may be a relatively minor influence on any given behavior, the aggregate impact of RD and RI on one’s total health and well-being may be significant.

As illustrated in Figure 1, beta coefficients for RD and RI vary markedly across the behaviors considered in this study. Our specific predictions regarding the relative strength of RD and RI with behaviors in the three different descriptive classes were largely supported. That is, above-average consumption of most items categorized as illicit, including cigarettes, gambling products, alcohol, and drugs, shared significantly stronger associations with RI than RD. Most food products measured (i.e., meat, salt, sweets, desserts, snacks, and caffeine) did not have significantly different associations with RD when compared to RI. Finally, entertainment items, including browsing online, sending SMS, social networking, reading magazines, and shopping), all shared significantly larger associations with RD.

These findings strengthen current conceptualizations of RD and RI. RD has been associated with socially driven behaviors (Clark et al., 2015) as well as more reflection and planning in approach to reward (Dawe et al., 2004). This is consistent with the pattern of effects seen here, in which RD predicted behaviors that tend to take relatively more cognitive effort, involve less immediate reward and more socially positive consequences. This may be seen in relatively stronger effects for the different forms of economic consumption, or communicating via digital media activities that generally take some planning and reflection, and lead to long-term rewards in terms of feelings of social interaction, affluence, or increased social standing. The relatively weaker effect observed for RI is understandable, given that it is conceptualized as a lack of control despite negative consequences (Dawe et al., 2004). This description is also consistent with the finding that RI was relatively more strongly associated with increased consumption of gambling, alcohol, smoking, and substance use; behaviors that provide immediate and intense reward for a very little effort, and for which the negative consequences are serious and well known (e.g., addiction, over-dose, and bankruptcy). RD and RI appear to be both independently associated with increased consumption, which can potentially be maladaptive, regardless of the product. However, our findings also support the notion that RI is most strongly associated with more unhealthy risky forms of consumption.

There were some notable exceptions to these patterns, where items did not conform to expectations based on their allotted category. For example, TV, video gaming, and Internet were more strongly predicted by RI than RD. In part, this reflects the previous study findings linking self-regulation and impulsivity to Internet use (e.g., Billieux & Van der Linden, 2012) and video gaming (Billieux et al., 2011). It may be that, although these activities often mimic social interaction (in the case of games) or provide for hedonic social observation (in the case of TV), they often lack the features of active social engagement that other items in this category possess. In addition, being related to RI but not RD, packaged food consumption did not conform to the same pattern of results as other food items. This may be due to the fact that the appeal of this product lies more in the quick satisfaction of a craving (hunger), rather than being particularly hedonically rewarding.

Limitations

This cross-sectional survey had several specific limitations connected with the goal to simultaneously assess a wide range of hedonic consumption behaviors. Due to the need to keep the total survey time reasonable, many behavioral measures were measured using just one or two items, which can be expected to lead to diminished effect sizes due to measurement error. Furthermore, predicting specific behaviors from general personality traits is known to suffer from a mismatch in levels of description, which also contributed to lower effect sizes (Epstein, 1979). The large sample size employed was designed to partially compensate for these two issues. \( R^2 \) values from this study, although small, in many cases were comparable to those from similar studies predicting actual behavior from personality traits (Loxton & Dawe, 2001; Gullo et al., 2011; Stojek, Fischer, Murphy, & MacKillop, 2014). In addition, with the exception of alcohol and gambling, behavioral variables were measured using novel self-report items that did not belong to a previously validated scale. This was somewhat compensated by the fact that items directly measured frequency of product consumption, reducing uncertainty around construct validity.

It is important to note that in this study, the BAS and BIS-11 were applied as broad measures of RD and RI. Each scale is made up of subscales that are likely to be differentially associated with the hedonic behaviors. RD as a construct continues to be refined and a new revised scale has been recently developed based on revised reinforcement sensitivity theory (rBAS; Jackson, 2009). This revised scale assesses the more functional aspects of RD (Clark et al., 2015; Harnett et al., 2013; Jackson, 2009; Jackson, Loxton, Harnett, Ciarrochi, & Gullo, 2014) and has less in common with RI. The measure of the original BAS used in this study tends to correlate more so with RI due to the inclusion of a “fun seeking” scale. Although the aim of this study was to predict hedonic consumption based on the broader constructs of RI and RD, future research might benefit from applying the updated BAS scale and investigating subscale effects as this may result in more pronounced unique effects of the two factors of impulsivity and a more detailed understanding of these effects. Furthermore, consumption of hedonic stimuli is often used as a form of “self-medication” due to the stimuli’s effect on reward centers in the brain (Markou, Kosten, & Koob, 1998; Tuomisto et al., 1999). This research did not control for factors, such as depression, anxiety, and positive and negative effects, and further research is recommended to identify the impact of these emotional and mood states/traits might have on the current findings.
CONCLUSION

To date, research into the effects of impulsivity on behavior has focused on single pathological or disordered behavioral outcomes. Furthermore, the recently realized two-factor model of impulsivity has been underused in such research. Our results suggest that the two-factor model of impulsivity has relevance in explaining a wide range of consumption behaviors in the general population. Taken in the aggregate, across both behaviors and individuals, these traits may play a significant role in determining health outcomes. Our findings strengthen the current conceptualizations of RI and RD. Results supported the interpretation that RD reflects reward approach in a reflective socially driven manner, whereas RI reflects an approach to intense reward that lacks controls and consideration for negative consequences. Excess consumption in the general population contributes to debt, emotional strain, and a variety of avoidable diseases. Understanding the psychological factors underlying an individual’s vulnerability to excessive consumption should play a useful role in future public health initiatives and research.

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REFERENCES

Benjami, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. Journal of the Royal Statistical Society. Series B (Methodological), 57(1), 289–300. Retrieved from http://www.jstor.org/stable/2346101

Benson, L. A., Norman, C., & Griffiths, M. D. (2011). The role of impulsivity, sensation seeking, coping, and year of study in student gambling: A pilot study. International Journal of Mental Health and Addiction, 10, 461–473. doi:10.1007/s11469-011-9326-5

Billieux, J., Chanal, J., Khazzaal, Y., Rochat, L., Gay, P., Zullino, & Van der Linden, M. (2011). Psychological predictors of problematic involvement in massive multiplayer online role-playing games: Illustration in a sample of male cybercafé players. Psychopathology, 44, 165–171. doi:10.1159/000322525

Billieux, J., Rochat, L., Rebetez, M. M. L., & Van der Linden, M. (2008). Are all facets of impulsivity related to self-reported compulsive buying behavior? Personality and Individual Differences, 44(6), 1432–1442. doi:10.1016/j.paid.2007.12.011

Billieux, J., & Van der Linden, M. (2012). Problematic use of the Internet and self-regulation: A review of the initial studies. The Open Addiction Journal, 5, 24–29. doi:10.2174/187494101205010024

Billieux, J., Van der Linden, M., & Rochat, L. (2008). The role of impulsivity in actual and problematic use of the mobile phone. Applied Cognitive Psychology, 22(9), 1195–1210. doi:10.1002/acp.v22:9

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): An effective brief screening test for problem drinking. Archives of Internal Medicine, 158(16), 1789–1795. doi:10.1001/archinte.158.16.1789

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. Journal of Personality and Social Psychology, 67, 319–333. doi:10.1037/0022-3516.67.2.319

Clark, D. M. T., Loxton, N. J., & Tobin, S. J. (2015). Multiple mediators of reward and punishment sensitivity on loneliness. Personality and Individual Differences, 72, 101–106. doi:10.1016/j.paid.2014.08.016

Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants: A proposal. Archives of General Psychiatry, 44(6), 573–588. doi:10.1001/archpsyc.1987.01800180093014

Darke, S., Kaye, S., McKetin, R., & Duflou, J. (2008). Major physical and psychological harms of methamphetamine use. Drug and Alcohol Review, 27(3), 253–262. doi:10.1080/09595230801923702

Davis, C., & Carter, J. C. (2009). Compulsive overeating as an addiction disorder. A review of theory and evidence. Appetite, 53(1), 1–8. doi:10.1016/j.appet.2009.05.018

Dawe, S., Gullo, M. J., & Loxton, N. J. (2004). Reward drive and rash impulsiveness as dimensions of impulsivity: Implications for substance misuse. Addictive Behaviors, 29, 1389–1405. doi:10.1016/j.addbeh.2004.06.004

Dawe, S., & Loxton, N. J. (2004). The role of impulsivity in the development of substance use and eating disorders. Neuroscience and Biobehavioral Reviews, 28(3), 343–351. doi:10.1016/j.neubiorev.2004.03.007

Dissabanda, L. O., Loxton, N. J., Dias, S. R., Dodd, P. R., Daglish, M., & Stadlin, A. (2014). Dependent heroin use and associated risky behaviour: The role of rash impulsiveness and reward sensitivity. Addictive Behaviors, 39(1), 71–76. doi:10.1016/j.addbeh.2013.06.009

Dong, G., Huang, J., & Du, X. (2011). Enhanced reward sensitivity and decreased loss sensitivity in Internet addicts: An fMRI study during a guessing task. Journal of Psychiatric Research, 45, 1525–1529. doi:10.1016/j.jpsychires.2011.06.017

Epstein, S. (1979). The stability of behavior: I. On predicting most of the people much of the time. Journal of Personality & Social Psychology, 37(7), 1097–1126. doi:10.1037/0022-3514.37.7.1097

Eysenck, H. J., & Eysenck, S. B. (1991). Manual of the Eysenck personality scales. London, UK: Hodder & Stoughton.
Goodwin, B. C., Browne, M., & Rockloff, M. (2015). Measuring preference for supernormal over natural rewards: A two-dimensional anticipatory pleasure scale. *Evolutionary Psychology, 13*(4). doi:10.1177/1474704915613914

Goodwin, B. C., Browne, M., Rockloff, M., & Loxton, N. J. (2016). Rash impulsivity predicts lower anticipated pleasure response and a preference for the supernormal. *Personality and Individual Differences, 94*, 206–210. doi:10.1016/j.paid.2016.01.030

Gray, J. A. (1970). The psychophysiological basis of introversion-extraversion. *Behaviour Research and Therapy, 8*(3), 249–266. doi:10.1016/0005-7967(70)90069-0

Gray, J. A. (1981). A critique of Eysenck’s theory of personality. In H. J. Eysenck (Ed.), *A model for personality* (pp. 246–276). Berlin: Springer-Verlag.

Guerrieri, R., Nederkoorn, C., & Jansen, A. (2008). The effect of an impulsive personality on overeating and obesity: Current state of affairs. *Psихологические Тенденции, 17*(2), 265–286.

Gullo, M. J., Loxton, N. J., & Dawe, S. (2014). Impulsivity: Four ways five factors are not basic to addiction. *Addictive Behaviors, 39*(11), 1547–1556. doi:10.1016/j.addbeh.2014.01.002

Gullo, M. J., Ward, E., Dawe, S., Powell, J., & Jackson, C. J. (2011). Support for a two-factor model of impulsivity and hazardous substance use in British and Australian young adults. *Journal of Research in Personality, 45*, 10–18. doi:10.1016/j.jrp.2010.11.002

Harnett, P. H., Loxton, N. J., & Jackson, C. J. (2013). Revised Reinforcement Sensitivity Theory: Implications for psychopathology and psychological health. *Personality and Individual Differences, 54*(3), 432–437. doi:10.1016/j.paid.2012.10.019

Jackson, C. J. (2009). Jackson-5 scales of revised Reinforcement Sensitivity Theory (r-RST) and their application to dysfunctional real world outcomes. *Journal of Research in Personality, 43*(4), 556–569. doi:10.1016/j.jrp.2009.02.007

Jackson, C. J., Loxton, N. J., Harnett, P., Ciarrochi, J., & Gullo, M. J. (2014). Original and revised Reinforcement Sensitivity Theory in the prediction of executive functioning: A test of relationships between dual systems. *Personality and Individual Differences, 56*, 83–88. doi:10.1016/j.paid.2013.08.024

Kane, T. A., Loxton, N. J., Staiger, P. K., & Dawe, S. (2004). Does the tendency to act impulsively underlie binge eating and alcohol use problems? An empirical investigation. *Personality and Individual Differences, 36*, 83–94. doi:10.1016/S0191-8869(03)00070-9

Loxton, N., & Dawe, S. (2001). Alcohol abuse and dysfunctional eating in adolescent girls: The influence of individual differences in sensitivity to reward and punishment. *International Journal of Eating Disorders, 29*, 455–462. doi:10.1002/(ISSN)1098-108X

Loxton, N. J., Nguyen, D., Casey, L., & Dawe, S. (2008). Reward drive, rash impulsivity and punishment sensitivity in problem gamblers. *Personality and Individual Differences 45*, 167–173. doi:10.1016/j.paid.2008.03.017

MacLaren, V. V., Fugelsang, J. A., Harrigan, K. A., & Dixon, M. J. (2012). Effects of impulsivity, reinforcement sensitivity, and cognitive style on pathological gambling symptoms among frequent slot machine players. *Personality and Individual Differences 52*, 390–394. doi:10.1016/j.paid.2011.10.044

Markou, A., Kosten, T. R., & Koob, G. F. (1998). Neurobiological similarities in depression and drug dependence: A self-medication hypothesis. *Neuropsychopharmacology, 18*(3), 135–174. doi:10.1016/S0893-133X(97)00113-9

McGlothlin, W. H., & West, L. J. (1968). The marihuana problem: An overview. *American Journal of Psychiatry, 125*(3), 370–378. doi:10.1176/ajp.125.3.370

Mora-Han-Martin, J. (2005). Internet abuse: Addiction? Disorder? Symptom? Alternative explanations? *Social Science Computer Review, 23*, 39–48. doi:10.1177/0894439304227153

Moreno-López, L., Soriano-Mas, C., Delgado-Rico, E., Rio-Valle, J. S., & Verdejo-García, A. (2012). Brain structural correlates of reward sensitivity and impulsivity in adolescents with normal and excess weight. *PLoS ONE, 7*(11). doi:10.1371/journal.pone.0049185

Noor, S. W., Rosser, B. S., & Erickson, D. J. (2014). A brief scale to measure problematic sexuality explicitly media consumption: Psychometric properties of the Compulsive Pornography Consumption (CPC) scale among men who have sex with men. *Sexual Addiction & Compulsivity, 21*(3), 240–261. doi:10.1080/10702012.2014.938849

Pentz, M. A., Spruijt-Metz, D., Chou, C. P., & Riggs, N. R. (2011). High calorie, low nutrient food/beverage intake and video gaming in children as potential signals for addictive behavior. *International Journal of Environmental Research and Public Health, 8*, 4406–4424. doi:10.3390/ijerph8124406

Petry, N. M. (2001). Substance abuse, pathological gambling, and impulsiveness. *Drug and Alcohol Dependence, 63*, 29–38. doi:10.1016/S0376-8716(00)00188-5

Rehn, J. (2011). The risks associated with alcohol use and alcoholism. *Alcohol Research & Health, 34*(2), 135–143. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/med/NHMS361546/

Rockloff, M. J. (2011). Validation of the Consumption Screen for Problem Gambling (CSPG). *Journal of Gambling Studies, 28*, 207–216. doi:10.1007/s10899-011-9260-2

Sansone, R. A., Chang, J., Jewell, B., & Sellbom, M. (2012). Compulsive buying: Associations with self-reported alcohol and drug problems. *The American Journal on Addictions, 21*, 178–179. doi:10.1111/ajad.2012.21.issue-2

Spinella, M. (2007). Normative data and a short form of the Barratt Impulsiveness Scale. *International Journal of Neuroscience, 117*(3), 359–368. doi:10.1080/00207450600588881

Stojek, M. M., Fischer, S., Murphy, C. M., & MacKillop, J. (2014). The role of impulsivity traits and delayed reward discounting in dysregulated eating and drinking among heavy drinkers. *Appetite, 80*, 81–88. doi:10.1016/j.appet.2014.05.004

Sussman, S., Lisha, N., & Griffiths, M. (2011). Prevalence of the addictions: A problem of the majority or the minority? *Evaluation & the Health Professions, 34*(1), 3–56. doi:10.1177/01966502103780124

Takao, M., Takahashi, S., & Kitamura, M. (2009). Addictive personality and problematic mobile phone use. *Cyber Psychology and Behavior, 12*(5), 501–507. doi:10.1089/cpb.2009.0022

Tuomisto, T., Hetherington, M. M., Morris, M. F., Tuomisto, M. T., Turjannaa, V., & Lappalainen, R. (1999). Psychobiological and physiological characteristics of sweet food “addiction”. *International Journal of Eating Disorders, 25*(2), 169–175. doi:10.1002/(ISSN)1098-108X
Ward, L. M., & Carlson, C. (2013). Modeling meanness: Associations between reality TV consumption, perceived realism, and adolescents’ social aggression. *Media Psychology, 16*(4), 371–389. doi:10.1080/15213269.2013.832627

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*(4), 669–689. doi:10.1016/S0191-8869(00)00064-7

Zuckerman, M., Eysenck, S. B., & Eysenck, H. J. (1978). Sensation seeking in England and America: Cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical Psychology, 46*, 139–149. doi:10.1037/0022-006X.46.1.139
### Table A1. Consumption behavior measures: Items included in each variable and response scales

| Variable                  | Question                                                                 | Response scale                                                                 |
|---------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| **Variable**              | **Question**                                                             | **Response scale**                                                             |
| **On a typical WEEK DAY/WEEKEND or WORKING DAY/NON-WORKING DAY,** *how much time do you spend each of the following:* | 1 = none, 2 = <10 min, 3 = 10–30 min, 4 = 30 min to 1 hr, 5 = 1–3 hr, 6 = 3–5 hr, 7 = 5–7 hr, 8 = 7+ hr |
| TV                        | Watching TV                                                              |                                                                                 |
| Internet                  | Browsing the internet on a computer, smart phone, or tablet              |                                                                                 |
| Social networking         | Using social networking websites (such as Facebook, Twitter, or My Space) |                                                                                 |
| Pornography               | Viewing erotic or romantic images, videos, or books                       |                                                                                 |
| Video gaming              | Gaming on a desktop computer, game console, portable gaming system, mobile phone, or tablet? |                                                                                 |
| **On average how often do you do the following:** | 1 = never, 2 = <once a week, 3 = 1–2 per week, 4 = 5–7 per week, 5 = twice a day, 6 = 3+ per day |
| Take away                 | Purchase foods for a meal or snack from fast food outlets, such as KFC, MacDonald’s, Hungry Jacks, and Red Rooster |                                                                                 |
| Take away                 | Purchase foods for a meal or snack from other food outlets, such as bakery, service station, ... Chinese food, etc. |                                                                                 |
| Desserts                  | Eat desserts, such as ice-cream, cake, and cookies                       |                                                                                 |
| Meat products             | Eat meat products? (such as sausages, frankfurter, Devon, fritz, salami, meat pies, bacon, or ham) |                                                                                 |
| Sweets                    | Eat chocolates, lollies, or other sweets                                  |                                                                                 |
| Snacks                    | Eat chips, crackers, or nuts                                            |                                                                                 |
| Soft drinks               | Drink NON-CAFFEINATED soft drinks, such as lemonade, etc.                |                                                                                 |
| Caffeine                  | Drink CAFFEINATED soft drinks, such as Coke or Pepsi                     |                                                                                 |
| Caffeine                  | Drink ENERGY drinks, such as Redbull, Mother, or V                        |                                                                                 |
| Caffeine                  | Drink TEA                                                                |                                                                                 |
| Caffeine                  | Drink COFFEE                                                            |                                                                                 |
| SMS                       | How often do you send a text message from your phone (not for work or business)? | 1 = never, 2 = once a week, 3 = 2–3 times per week, 4 = almost every day, 5 = once a day, 6 = 2–3 times a day, 7 = 3–5 times a day, 8 = 5–7 times a day, 9 = 7+ times per day |
| Social networking         | How often do you check your social networking account (e.g., Facebook, Twitter, or My Space) | 1 = never, 2 = <once a week, 3 = once a day, 4 = 1–10 times per day, 5 = 10–20 times per day, 6 = 30–40 times per day, 7 = 50+ times per day |
| Caffeine                  | When you drink COFFEE, how much would you typically drink in one sitting? (one serve is equal to either one espresso shot or one teaspoon of instant coffee) | 1 = I do not drink coffee, 2 = 1 serve, 3 = 2 serves, 4 = 3+ serves |
| Salt                      | How often do you add salt to your food WHILE cooking or preparing it?    | 1 = never, 2 = rarely, 3 = sometimes, 4 = usually |
| Salt                      | How often do you add salt to your food AFTER cooking or preparing it?    | 1 = never, 2 = rarely, 3 = sometimes, 4 = usually |
| Soft drink                | When you drink NON-CAFFEINATED soft drink (such as lemonade, etc.) how much would you typically drink in one sitting? | 1 = I do not drink soft drink, 2 = <250 ml (small glass), 3 = 250–400 ml (small can or bottle), 4 = 400 ml to 1 L (mid bottle), 5 = 1+ L |
| Caffeine                  | When you drink CAFFEINATED soft drink (such as lemonade, etc.) how much would you typically drink in one sitting? | 1 = I do not drink soft drink, 2 = <250 ml (small glass), 3 = 250–400 ml (small can or bottle), 4 = 400 ml to 1 L (mid bottle), 5 = 1+ L |
| Variable   | Question                                                                 | Response scale                                                                 |
|------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Caffeine   | When you drink ENERGY soft drink (such as lemonade, etc.) how much would | 1 = I do not drink soft drink, 2 = <250 ml (small glass), 3 = 250–400 ml (small |
|            | you typically drink in one sitting?                                       | can or bottle), 4 = 400 ml to 1 L (mid bottle), 5 = 1+ L                        |
| Drugs      | Have you used any illicit drugs in the past 12 months?                     | 1 = never, 2 = once a month or less, 3 = 2–4 times per month, 4 = 2–3 times per |
|            | This includes drugs, such as cannabis, amphetamines, etc.                 | week, 5 = 4–5 times per week, 6 = 6+ times per week.                             |
| Shopping   | Approximately how many new items of clothing do you purchase for yourself | 1 = none, 2 = <one item a month, 3 = 1–2 items a month, 4 = 3–5 items a month, |
|            | you purchase for yourself per month? Include things, such as shoes, tops, | 5 = 6–10 items a month, 6 = 11–15 items a month, 7 = 15+ items per month        |
|            | pants, jackets, and so on                                                |                                                                                 |
| Shopping   | Approximately how many collectible items do you purchase for yourself per | 1 = none, 2 = <one item a month, 3 = 1–2 items a month, 4 = 3–5 items a month, |
|            | month? Include things, such as DVDs or Blu-ray movies, CDs, Books, Games, | 5 = 6–10 items a month, 6 = 11–15 items a month, 7 = 15+ items per month        |
|            | or other collectables                                                    |                                                                                 |
| Brochures  | How often do you browse advertising catalogs that arrive in the mail?     | 1 = never, 2 = once a month, 3 = 2–3 times per month, 4 = once a week, 5 = 2–3 |
|            |                                                                        | times per week, 6 = almost everyday                                             |
| Browse online | How often do you browse or search for retail products on online shopping | 1 = never, 2 = once a month, 3 = 2–3 times per month, 4 = once a week, 5 = 2–3 |
|            | websites?                                                                 | times per week, 6 = almost everyday                                             |
| Packaged food | When grocery shopping, what percentage of your trolley or basket would | 1 = 0%, 2 = <20%, 3 = 20–40%, 4 = 40–60%, 5 = 60–80%, 6 = 80–100%               |
| Alcohol    | AUDIT C (for items and scale see Bush et al., 1998)                       |                                                                                 |
| CSPG       | CSPG (for items and scale see Rockloff, 2011)                             |                                                                                 |

*Two separate questions were asked for working and non-working days for these items. Scale previously published in (Goodwin et al., 2015).