Validity of a Norwegian version of the Desire Thinking Questionnaire (DTQ): Associations with problem drinking, nicotine dependence, and problematic social media use

Stian Solem1, Henrik Pedersen1, Frikk Nesse1, Arne Garvik Janssen1, Leif Edward Ottesen Kennair1, Roger Hagen1, Audun Havnen1, Odin Hjemdal1, Gabriele Caselli2 and Marcantonio M. Spada3

1 Norwegian University of Science and Technology, Trondheim, Norway

2 Studi Cognitivi, Milan, Italy

3 London South Bank University, London, UK

Running head: Norwegian DTQ

Corresponding author:

Stian Solem

Norwegian University of Science and Technology

7491 Dragvoll

Norway

[stian.solem@ntnu.no](mailto:stian.solem@ntnu.no)

**Abstract**

The aim of the current study was to test the validity of the Norwegian version of the Desire Thinking Questionnaire (DTQ). Three cross-sectional surveys were conducted investigating the psychometric properties of the DTQ in alcohol use (N = 588), nicotine use (N = 446), and social media use (N = 359). Principal components and confirmatory factor analyses supported the original two-factor solution consisting of verbal perseveration (VP) and imaginal prefiguration (IP), however, one item was removed to obtain good fit. Internal consistency was acceptable. Both IP and VP showed significant correlations with problem drinking, nicotine dependence and problematic social media use. Regression analyses, controlling for demographics and negative affect, found IP and VP to be significantly associated with all dependent variables. The results confirm that desire thinking is an important construct across different addictive behaviours.

*Keywords:* alcohol; desire thinking; nicotine; psychometrics; validation study; social media.

**Introduction**

A key element to the phenomenon of addictive behaviour is craving. Craving is defined as a strong subjective sensation of anticipation and desire for the effects of an activity or a substance (Marlatt, 1987). Research has demonstrated that craving is important in maintenance and relapse across addictive behaviours (Bottlender & Soyka, 2004; Caselli & Spada, 2010; Gordon et al., 2006; Schneekloth et al., 2012). Managing, reducing, and stopping the escalation of craving is therefore considered a crucial therapeutic target in the treatment of addictive behaviours (Oei, Raylu, & Casey, 2010; O’Malley, Krishnan-Sarin, Farren, Sinha, & Kreek, 2002; Paille et al., 1995).

The Elaborated Intrusion Theory of desire suggests that desire, or craving, is the product of both automatic bottom-up associative and controlled top-down cognitive processes (Kavanagh, Andrade & May, 2005; May, Kavanagh & Andrade, 2015). Both internal (e.g. negative mood or withdrawal symptoms) and external triggers (e.g. seeing someone smoking a cigarette) are presumed to activate associative information about a desired target thus giving rise to intrusive thoughts, often accompanied by craving. In samples of individuals suffering from addictive behaviours these intrusive thoughts and accompanying craving can enter and exit consciousness, however, if the target is associated with relief or pleasure, cognitive elaboration is more likely to ensue (Kavanagh, May & Andrade, 2009). One conceptualization of this cognitive elaboration is termed “desire thinking” (Caselli & Spada, 2010; 2011).Caselli and Spada argue that desire thinking is a voluntary form of cognitive elaboration aimed at reducing, in the short-term, craving associated with initial intrusive thoughts by evoking sensations similar to actual engagement in the desired activity (Bywaters et al., 2004; Witvliet & Vrana, 1995). In the long-term, however, desire thinking leads to the preservation and escalation of craving. The relief from discomfort is temporary while the focus on the desired target persists, giving rise to even more associative information about the desired target. Consequently, this increases the initial craving leading to a downward spiral in which engagement with the desired target is seen as the only solution. Desire thinking is a two-dimensional construct and consists of *verbal perseveration* (VP) and *imaginal prefiguration* (IP; Caselli & Spada, 2011). Verbal perseveration is defined as self-talk elaborating on the need to achieve the desired target, while imaginal prefiguration involves the construction of mental sensory images of the desired target, typically involving taste, vision or psychoactive effects of the addictive behaviour (Caselli & Spada, 2010; Kavanagh, May & Andrade, 2009).

The Desire Thinking Questionnaire (DTQ; Caselli & Spada, 2011) is a self-report instrument, which aims is to measure an individual’s propensity to engage in desire thinking. The DTQ has been used in several studies, through which desire thinking has been found to be a significant predictor of a range of addictive behaviours, including alcohol (Caselli et al., 2012; 2013; 2015; Caselli & Spada, 2011; Caselli & Spada, 2015; Martino et al., 2017; 2019; Spada et al., 2015), nicotine (Caselli et al., 2012; Caselli & Spada, 2015), problematic Internet and Facebook use (Spada, Caselli, Slaifer, Nikcevic, & Sassaroli, 2014; Caselli & Spada, 2015; Marino et al., 2019), problematic internet pornography use (Allen, Kannis-Dymand, & Katsikitis, 2017), and gambling (Fernie et al., 2014). A recent meta-analysis (Mansueto et al., 2019) concluded that both components of desire thinking were associated with different addictive behaviours (e.g., alcohol use, nicotine use, gambling, and problematic internet use). In experimental studies, desire thinking has been shown to both increase craving in a self-chosen addictive behaviour in a community sample and the urge to drink in a small group of patients in treatment for alcohol related problems (Caselli, Gemelli & Spada, 2016; Caselli, Soliani & Spada, 2013).

Taken together, these findings indicate that desire thinking may be an important factor in the conceptualisation and treatment of a range of addictive behaviours (Caselli et al., 2012; May, Kavanagh & Andrade, 2015). It has also been suggested that interrupting and reducing desire thinking may be a more appropriate treatment target than reducing craving directly (Caselli & Spada, 2016). Through the metacognitive models of addictive behaviours and desire thinking (Caselli & Spada, 2015; Spada et al., 2015), a link has been provided between a potential metacognitive therapy for addictive behaviours and established metacognitive therapeutic approaches for anxiety and depression (Wells, 2009; Normann and Morina, 2018). In this model desire thinking is considered a type of extended thinking analogous to rumination and worry, and its dysregulation is mainly caused by maladaptive metacognitive beliefs concerning its usefulness, uncontrollability and danger to the self. The goal of treatment is then to challenge these beliefs, change the relation to one’s thoughts and inner sensations, and enhance metacognitive awareness, thus increasing cognitive flexibility.

In addition to the English version, a French, Dutch, Polish, and Hebrew versions of the DTQ have been validated (Chakroun-Baggioni et al., 2017; Dragan & Grajewski, 2021; Efrati et al., in press; Markus, et al., 2019). The studies confirmed the original two-factor structure, and the DTQ was found to be associated with craving, at-risk drinking, gaming, and compulsive sexual behaviour. However, the Hebrew version used on adolescents found a 9-item two-factor structure (removing item 8), and their confirmatory factor analysis supported a 6-item two-factor structure. In view of the growing research base on the importance of desire thinking in addictive behaviours, the aim of the current study was to test the validity of a Norwegian version of the DTQ and determine its predictive powers in relation to problem drinking, nicotine dependence and problematic social media use. Our main hypothesis was that the DTQ would show significant associations with these outcomes independently of demographic factors and negative affect.

**Method**

The study was reported to, and registered by, the Norwegian Centre for Research Data (ref. nr. 53698). The study was not required to report to the Regional Committees for Medical and Health Research Ethics because anonymity was adequately ensured with the use of a voluntary online survey design. Relevant information about the study was presented along with the survey for the participants to read before responding. Participants were required to: (1) be 18 years or older; (2) consent to being part of the study; (3) understand written Norwegian; and (4) answer at least 75% of the items constituting each measure. The participants did not get any compensation or payment for completing the survey.

The first study sample targeted alcohol use. Data was collected between May 2017 and March 2019, resulting in a total of 588 respondents. Invitation to the online survey about alcohol use was presented on multiple platforms: through social media, in university lectures, and via e-mail to psychology students. An addiction treatment centre also shared the survey on their Facebook page.

The second study sample targeted nicotine use (*N* = 446). Participants were also invited through a Facebook-page managed by the Norwegian Directorate of Health, which offers guidance to people that wish to quit smoking or quit using snus (a smokeless tobacco product). Data was collected between May 2017 and April 2019. Thirty of the included participants reported that they no longer used nicotine (6.7%), while the rest identified themselves as either smokers (38.8%), snus users (48.9%), or both (5.6%).

The third sample consisted of 359 social media users. Participants were recruited from e-mail lists for psychology students, on Facebook, and students were recruited from lectures. Data was collected between May 2017 and March 2018. A summary of the samples’ demographic variables, desire thinking scores, and scores on outcome measures are displayed in Table 1.

We also asked participants to report (yes/no) other possible addictions. For the nicotine sample, there were 14 participants (3.1%) who reported an alcohol addiction, and 39 (8.7%) reported social media addiction. For the alcohol sample, there were 137 participants (23.3%) that reported nicotine addiction, and 74 social media addiction (12.6%). For the social media sample, there were seven participants (1.9%) that reported alcohol addiction, and 84 (23.4%) nicotine addiction.

Insert Table 1 here

**Measures**

*The Desire Thinking Questionnaire* (DTQ; Casellli & Spada, 2011) is a 10-item self-report questionnaire constructed to assess desire thinking. It consists of two factors of five items each: (1) *verbal perseveration* (VP) and (2) *imaginal prefiguration* (IP). Each item is a statement describing elaborating thoughts about an addictive behaviour. An example of a statement about verbal perseveration (in the alcohol use survey) is “I repeat mentally to myself that I need to drink”, while an example of imaginal prefiguration (in the nicotine use survey) is “I imagine how I would feel like when using nicotine”. The respondent is asked to rate how often they engage in such thinking patterns themselves. This is reported on a 4-point Likert-scale, where 1 = “Almost never”, 2 = “Sometimes”, 3 = “Often” and 4 = “Almost always”. Hence, a higher score indicates that the respondent frequently engages in desire thinking related to the behaviour. In the original questionnaire by Caselli & Spada (2011) the statements did not specify what activity is desired, instead referring to a “desired activity”. In our study, each statement specified either alcohol use (sample 1), nicotine use (sample 2), or social media use (sample 3).

Two Norwegian senior academics familiar with metacognitive theory produced a Norwegian translation of the original English version of the DTQ. The Norwegian translation was translated back into English by a bilingual senior academic blind to the original version. A comparison of the back-translation with the original English version of the DTQ revealed only minor discrepancies. The readability score was 34, indicating that the text is easily understood.

*The Patient Health Questionnaire* (PHQ-4; Kroenke et al., 2009) is a 4-item self-report questionnaire constructed as an ultra-brief instrument screening for depression and anxiety. The PHQ-4 is a shortened version of the PHQ-9 (Kroenke et al., 2001), which consists of 9 items. The instrument begins by asking “Over the last 2 weeks, how often have you been bothered by the following problems?”, followed by the 4 items. 2 items relate to depression (e.g. “Little interest or pleasure in doing things), while the other 2 relate to anxiety (e.g. “Feeling nervous, anxious or on edge”). Items are scored on a 4-point Likert scale with scores from 0 to 4, where 0 = “Not at All”, 1 = “Several Days”, 2 = “More Than Half the Days” and 3 = “Nearly Every Day”.  Total scores can therefore range from 0 to 12, with higher scores indicating an increase in symptom severity.

*The Alcohol Use Disorders Identification Test* (AUDIT; Babor, Higgins-Biddle, Saunders & Monteiro, 2001)is a screening tool assessing alcohol consumption and its consequences. The instrument has 10 questions covering hazardous and harmful alcohol use and dependence symptoms. Responses are scored on a 0-4 scale, where a higher score indicates problematic alcohol use. There have been varying suggestions regarding the interpretation of AUDIT score. A cut-off score of 15 could be utilized for an at-risk group (Johnson et al., 2013), whilst scores of 7-15 could be considered to be at moderate risk, and scores of 6 or lower as non-problem drinking.”

*The Fagerström Test of Nicotine Dependence* (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) was used to measure nicotine dependence. It consists of six items added to a single factor, with scores ranging from 0 to 10, where higher scores indicate higher nicotine dependence. The FTND includes questions concerning both nicotine craving (Do you find it difficult to refrain from smoking in places where it is forbidden e.g. in church, at the library, in cinema, etc.?) and behavior (How many cigarettes/day do you smoke?), or both (How soon after you wake up do you smoke your first cigarette?). Two questions have four potential answers (coded 0-3) and the rest have two options (coded 0-1). Earlier research has used cut-off values of 3 and 5 to indicate moderate and high nicotine dependence (Caselli, Ferla, Mezzaluna, Rovetto & Spada, 2012).

*Problematic Social Media Use* (PSMU; Marino, Vieno, Altoe, & Spada, 2017). We also included a measure of social media use based on Caplan’s (2010) 15-item scale measuring problematic internet use, replacing “internet” with “social media”. The measure uses a 1-8 scale giving a total score with a possible range from 15 to 120. Higher scores indicate higher levels of problematic social media use.

**Statistical analyses**

A principal-components analysis (PCA) was conducted using the sample of nicotine users with direct Oblimin rotation and Kaiser normalization, followed by a confirmatory factor analysis using the alcohol use sample. These two samples were used as they had the largest sample sizes. Data was subjected to confirmatory factor analyses using Mplus version 8.4. using the robust full-information maximum likelihood (MLR) method. Goodness-of-fit was evaluated using three fit indices including the Standardized Root Mean Square Residual (SRMR), the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI). Conventional cut-offs for fitting indices were as follows: SRMR ≤ .05, RMSEA ≤ .06, CFI ≥ .90 (Hu and Bentler, 1999). Bivariate correlations were calculated to investigate the relationship between DTQ and different outcome variables. Finally, linear hierarchical regression analyses were conducted controlling for demographic variables and negative affect. Demographic variables were entered on step 1, before including depression and anxiety on step 2. The metacognitive measures were entered on separate steps with the order of entry based on their theorized temporal sequence of activation (Caselli & Spada, 2015) with IP on step 3, and VP on step 4.

**Results**

The PCA on sample two supported the original two-factor solution. However, item 8 loaded onto VP rather than IP. Factor loadings were above .4 with a minimum discrepancy across factors of .2. A summary of the PCA is displayed in table 2.

Insert Table 2 here

A confirmatory factor analysis using sample one found poor fit for the original solution, χ2(34) = 96.14, *p* < .001, CFI = .909, RMSEA = .0056, SRMR = .072. When removing item 8 the fit improved, χ2(26) = 52.23, *p* = .002, CFI = .954, RMSEA = .041, SRMR = .062. No other modifications were made to the model.

The following analyses therefore used the revised IP factor. VP consisted of item 4, 5, 6, 7, and 10 as in the original. IP consisted of items 1, 2, 3, and 9. In sample 1, the Cronbach’s alpha was .76 for IP, and .82 for VP. In sample two, they were .74 for IP and .89 for VP. In sample three, they were .65 for IP and .78 for VP.

IP and VP were significantly correlated with all outcome variables in all samples. A summary of the correlation analyses is displayed in Table 3. Strength of correlations ranged from weak (*r* = .29) to moderate (*r* = .58). Depression and anxiety symptoms showed a stronger relationship to social media use than alcohol and nicotine use.

Insert Table 3 here

Three linear hierarchical regression analyses were conducted controlling for demographics and negative affect (anxiety and depression). IP and VP significantly increased the amount of explained variance for all four regressions. The models explained 29-39% of the variance in the dependent variables. IP and VP were unique predictors of all outcome measures, except for IP in social media use. A summary of the regression analyses is displayed in Table 4. There were no indications of multicollinearity as the highest VIF value and lowest tolerance value for the problem drinking regression was 2.11 and .51 respectively, for nicotine use it was 1.89 and .53., and for social media it was 1.72 and .58.

Insert Table 4 here

**Discussion**

The aim of this study was to explore the validity of the Norwegian DTQ using three individual samples, considering three different addictive behaviours (alcohol use, nicotine use and social media use). Principal components and confirmatory factor analyses supported the original two-factor solution, but three items were removed in order to obtain good fit. Both IP and VP showed acceptable internal consistency, and significant correlations with the dependent variables in all three samples. Regression analyses controlling for demographics and negative affect found IP and VP to be significantly associated with addictive behaviours.

The factor analyses of the Norwegian DTQ removed item 8 to achieve good fit. In contrast, the French and the Dutch versions of DTQ found acceptable fit for the original two-factor solution (Chakroun-Baggioni et al., 2017; Markus et al., 2018). However, as in our study, the French study also found that item 9 had the weakest factor loading and that item 8 had a side loading. Differences observed in our study could be due to translation issues, sample variation, and cultural differences. The current study had samples that were younger than the Dutch social media sample and older than the French student sample.

Strength of correlations between desire thinking and the outcome variables ranged from weak to moderate. VP showed stronger correlations with nicotine dependence and problematic social media use (*r* = .29 vs. .58 for nicotine dependence, and .34 vs. .54 for problematic social media use), while there were no clear differences for problem drinking. In comparison, previous research has found non-significant differences between IP and VP in explaining nicotine use (Caselli et al. 2012), and IP to be a stronger predictor of problematic Internet use than VP (Spada et al., 2014). The results differ therefore somewhat from previous findings. Possible explanations could be due to the revised translated version and sample differences (e.g. cultural differences).

Negative affect on the other hand showed weak correlations with problem drinking and nicotine dependence, but stronger associations with problematic social media use. A possible explanation could be that social media use is associated with social isolation for some groups (e.g. Whaite et al., 2018) and could increase rumination in the form of social comparisons (Vogel et al., 2014). Negative emotional consequences are likely to occur in problem drinking as well, however, few participants reported serious problems with alcohol use in the current study when inspecting average scores on AUDIT. The models also showed that there were significant sex differences, as men displayed higher levels of nicotine dependence and problem drinking. In addition, there was a significant effect of age for all three models. Younger people presented higher scores on problem drinking and problematic social media use but reported lower scores on nicotine dependence.

The regression models explained 29-39% of the variance in outcome variables. IP was added on the third step and added 7-12%, while VP on the final step, added an additional 3-19% of total variance explained. Previous research has suggested that desire thinking is important in a range of addictive behaviours (e.g. Caselli et al., 2012; Caselli et al., 2015; Caselli & Spada, 2015; Marino et al., 2019; Martino et al., 2017; Spada et al., 2014; 2015). Looking at our findings in finer detail indicates that VP is a stronger predictor than IP for both nicotine dependence and problematic social media use. Conversely, IP appears to be a marginally stronger predictor for problem drinking. A possible explanation for these differences is that VP tends to be a marker of ore severe addictive behaviour (Caselli et al., 2015; Mansueto et al., 2019). In the current study, the average FTND score indicates low to moderate levels of dependence which would support the view that VP should be a more important predictor than IP. The same argument should be applicable to problematic social media use, however the average scores on problematic social media use were relatively low in the sample. It may be the case, therefore, that though problematic social media use is low, the amount of time engaged in social media use may be perceived as excessive or problematic, hence the dominating presence of VP. In the absence of data to corroborate or not this hypothesis this remains a speculative deliberation. The finding that IP predicted problem drinking marginally more than VP aligns itself to what has been observed in other studies in populations who present medium to low levels of problem drinking (Mansueto et al., 2019).

This study has several limitations that need to be acknowledged. Firstly, its cross-sectional design prevents inference of causality. Therefore, future research should use longitudinal or experimental designs. Secondly, all measures were based on self-report. Another limitation concerns the use of a convenience sampling strategy. The nicotine use sample was more clearly defined and recruited, whilst the other two samples were not. As a result, the DTQ scores for the nicotine use sample were elevated signifying greater levels of addictive behaviour. Another weakness of the study is that we did not collect test-retest data on the DTQ. Future research should explore related results using clinical samples. As more research supports desire thinking having a central role in addictive behaviours, future research should also explore possible treatment interventions, which aim to interrupt and discontinue desire thinking as a coping strategy. The metacognitive model of desire thinking proposes both the underlying mechanism to its dysregulation and possible treatment approaches and may therefore guide future clinical research (Caselli & Spada, 2015).

In conclusion, previous research has suggested that desire thinking is important in a range of addictive behaviours (e.g. Caselli et al., 2012; Caselli et al., 2015; Caselli & Spada, 2015; Marino et al., 2019; Martino et al., 2017; 2019; Spada et al., 2014; 2015). The current study supports these findings and add further cross-cultural evidence. The DTQ with its two subscales IP and VP showed significant associations with problem drinking, nicotine dependence, and problematic social media use.

**References**

Allen, A., Kannis-Dymand, L., & Katsikitis, M. (2017). Problematic internet pornography use: The role of craving, desire thinking, and metacognition. *Addictive behaviors, 70*, 65-71. doi:10.1016/j.addbeh.2017.02.001

Babor, T. F., & Robaina, K. (2016). The Alcohol Use Disorders Identification Test (AUDIT): A review of graded severity algorithms and national adaptations. *The International Journal of Alcohol and Drug Research, 5*, 17-24. doi:10.7895/ijadr.v5i2.222

Babor, T. F., Higgins-Biddle, J., Saunders, J. B., & Monteiro, M. G. (2001). *AUDIT The Alcohol Use Disorders Identification Test: Guidelines for use in primary care* (*2nd ed*.). Geneva, Switzerland: World Health Organization.

Bottlender, M., & Soyka, M. (2004). Impact of craving on alcohol relapse during, and 12 months following, outpatient treatment. *Alcohol and Alcoholism, 39*, 357-361. doi:10.1093/alcalc/agh073

Caplan, S. E. (2010). Theory and measurement of generalized problematic Internet use: A two-step approach. *Computers in Human Behavior, 26*, 1089-1097. doi:10.1016/j.chb.2010.03.012.

Chakroun-Baggioni, N., Corman, M., Spada, M.M., Caselli, G., & Gierski,F (2017). Desire thinking as a confounder in the relationship between mindfulness and craving: Evidence from a cross-cultural validation of the Desire Thinking Questionnaire. *Psychiatry Research, 256*, 188-193. doi:10.1016/j.psychres.2017.06.051.

Caselli, G., Ferla, M., Mezzaluna, C., Rovetto, F., & Spada, M. M. (2012). Desire thinking across the continuum of drinking behaviour. *European Addiction Research, 18*, 64-69. doi:10.1159/000333601

Caselli, G., Gemelli, A., Querci, S., Lugli, A. M., Canfora, F., Annovi, C., et al. (2013). The effect of rumination on craving across the continuum of drinking behaviour. *Addictive behaviors. 38*, 2879–2883. doi:10.1016/j.addbeh.2013.08.023

Caselli, G., & Spada, M. M. (2010). Metacognitions in desire thinking: A preliminary investigation. *Behavioural and Cognitive Psychotherapy*, *38*, 629-637. doi:10.1017/s1352465810000317

Caselli, G., & Spada, M. M. (2011). The desire thinking questionnaire: Development and psychometric properties. *Addictive Behaviors, 36*, 1061-1067. doi:10.1016/j.addbeh.2011.06.013

Caselli, G., & Spada, M. M. (2015). Desire thinking: What is it and what drives it? *Addictive behaviors, 44*, 71-79. doi:10.1016/j.addbeh.2014.07.021

Dragan, M., & Grajewski, P. (2021). Psychometric properties of the Polish version of the desire thinking questionnaire in a sample of Internet game players. *Addictive Behaviors, 112*. doi:10.1016/j.addbeh.2020.106653

Efrati, Y., Kolubinski, D. C., Caselli, G., & Spada, M. M. (in press). Desire thinking as a predictor of compulsive sexual behaviour in adolescents: Evidence from a cross-cultural validation of the Hebrew version of the Desire Thinking Questionnaire. *Journal of Behavioral Addictions*.

Fagerström, K.O., Heatherton, T. F., & Kozlowski, L. T. (1992). Nicotine addiction and its assessment. *Ear Nose & Throat Journal, 69*, 763-765.

Fernie, B. A., Caselli, G., Giustina, L., Donato, G., Marcotriggiani, A., & Spada, M. M. (2014). Desire thinking as a predictor of gambling. *Addictive Behaviors, 39*, 793-796. doi:10.1016/j.addbeh.2014.01.010

Gordon, S. M., Sterling, R., Siatkowski, C., Raively, K., Weinstein, S., & Hill, P. C. (2006). Inpatient desire to drink as a predictor of relapse to alcohol use following treatment. *The American Journal on Addictions, 15*, 242-245. doi:10.1080/10550490600626556

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55. doi:10.1080/10705519909540118

Johnson, J. A., Lee, A., Vinson, D., & Seale, J. P. (2013). Use of AUDIT‐based measures to identify unhealthy alcohol use and alcohol dependence in primary care: a validation study. *Alcoholism: Clinical and Experimental Research*, *37*, E253-E259. doi:10.1111/j.1530-0277.2012.01898.x

Kavanagh, D. J., Andrade, J., & May, J. (2005). Imaginary relish and exquisite torture: the elaborated intrusion theory of desire. *Psychological review, 112*, 446-467. doi:10.1037/0033-295X.112.2.446

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2003). The Patient Health Questionnaire-2: validity of a two-item depression screener. *Medical care, 11*, 1284-1292. doi:10.1097/01.MLR.0000093487.78664.3C

Kroenke, K., Spitzer, R. L., Williams, J. B., Monahan, P. O., & Löwe, B. (2007). Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Annals of internal medicine, 146*, 317-325. doi:10.7326/0003-4819-146-5-200703060-00004

Mansueto, G., Martino, F., Palmieri, S., Scaini, S., Ruggiero, G. M., Sassaroli, S., & Caselli, G. (2019). Desire Thinking across addictive behaviours: A systematic review and meta-analysis. *Addictive Behaviors, 98*. doi:10.1016/j.addbeh.2019.06.007.

Markus, W., Burk, W. J., de Weert-van Oene, G. H., Engel, C., Becker, E. S., & DeJong, C. A. J. (2019). Psychometric validation of the Dutch version of the Desire Thinking Questionnaire (DTQ-D). *European Journal of Psychological Assessment, 35*, 868–877. doi:10.1027/1015-5759/a000462

Marlatt, G. A. (1987). Craving notes. *British Journal of Addiction, 82*, 42–44. doi:10.1111/j.1360-0443.1987.tb01434.x

Marino, C., Caselli, G., Lenzi, M., Monaci, M. G., Vieno, A., Nikčević, A. V., & Spada, M. M. (2019). Emotion Regulation and Desire Thinking as Predictors of Problematic Facebook Use. *Psychiatric Quarterly, 90*, 405-411. doi:10.1007/s1112

Marino, C., Vieno, A., Altoe, G., & Spada, M.M. (2017). Factorial validity of the Problematic Facebook Use Scale for adolescents and young adults. *Journal of Behavioral Addictions, 6*, 5-10. doi: 10.1556/2006.6.2017.004

Martino, F., Caselli, G., Felicetti, F., Rampioni, M., Romanelli, P., Troiani, L., ... & Spada, M. M. (2017). Desire thinking as a predictor of craving and binge drinking: a longitudinal study. *Addictive behaviors*, *64*, 118-122. doi:10.1016/j.addbeh.2016.08.046

Martino, F., Caselli, G., Fiabane, E., Felicetti, F., Trevisani, C., Menchetti, M., ... & Spada, M. M. (2019). Desire thinking as a predictor of drinking status following treatment for alcohol use disorder: A prospective study. *Addictive behaviors, 95*, 70-76. doi:10.1016/j.addbeh.2019.03.004

May, J., Kavanagh, D. J., & Andrade, J. (2015). The elaborated intrusion theory of desire: a 10-year retrospective and implications for addiction treatments. *Addictive Behaviors, 44*, 29-34. doi:10.1016/j.addbeh.2014.09.016

Normann, N., and Morina, N. (2018). The efficacy of metacognitive therapy: a systematic review and meta-analysis. *Frontiers in Psychology, 9:2211*. doi:10.3389/fpsyg.2018.02211

O’Malley, S. S., Krishnan-Sarin, S., Farren, C., Sinha, R., & Kreek, J. (2002). Naltrexone decreases craving and alcohol self-administration in alcohol-dependent subjects and activates the hypothalamo–pituitary–adrenocortical axis. *Psychopharmacology, 160*, 19–29. doi:10.1007/s002130100919

Oei, T. P., Raylu, N., & Casey, L. M. (2010). Effectiveness of group and individual formats of a combined motivational interviewing and cognitive behavioral treatment program for problem gambling: A randomized controlled trial. *Behavioral and Cognitive Psychotherapy, 38*, 233–238. doi:10.1017/S1352465809990701

Paille, F. M., Guelfi, J. D., Perkins, A. C., Royer, R. J., Stern, L., & Parot, P. (1995). Double-blind randomized multicentre trial of acamprosate in maintaining abstinence from alcohol. *Alcohol and Alcoholism, 30*, 239–247. doi:10.1093/oxfordjournals.alcalc.a045720

Schneekloth, T. D., Biernacka, J. M., Hall‐Flavin, D. K., Karpyak, V. M., Frye, M. A., Loukianova, L. L., ... & Mrazek, D. A. (2012). Alcohol craving as a predictor of relapse. *The American journal on addictions, 21*, S20-S26. doi:10.1111/j.1521-0391.2012.00297.x

Spada, M. M., Caselli, G., Nikčević, A. V., & Wells, A. (2015). Metacognition in addictive behaviors. *Addictive behaviors, 44*, 9-15. doi:10.1016/j.addbeh.2014.08.002

Spada, M. M., Caselli, G., Slaifer, M., Nikčević, A. V., & Sassaroli, S. (2014). Desire thinking as a predictor of problematic Internet use. *Social Science Computer Review, 32*, 474-483. doi:10.1177/0894439313511318

Vogel, E. A., Rose, J. P., Roberts, L. R., & Eckles, K. (2014). Social Comparison, Social Media, and Self-Esteem. *Psychology of Popular Media Culture, 3*, 206 –222. doi:10.1037/ppm0000047

Wells, A. (2009). *Metacognitive therapy for anxiety and depression*. New York: Guilford Press.

Whaite, E. O., Shensa, A., Sidani, J. E., Colditz, J. B., & Primack, B. A. (2018). Social media use, personality characteristics, and social isolation among young adults in the United States. *Personality and Individual Differences, 124*, 45-50, doi:10.1016/j.paid.2017.10.030.

Table 1.

Descriptive info for all three samples.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Sample 1, Alcohol use (N=588) | | Sample 2, Nicotine use (N=446) | | Sample 3, Social media use  (N=359) | |
|  | M (SD) | N/% | M (SD) | N/% | M (SD) | N/% |
| **Demographics** |  |  |  |  |  |  |
| Female sex |  | 365 (62.1) |  | 293 (65.7) |  | 221(61.6) |
| Age | 35.1 (15.2) |  | 35.4 (13.8) |  | 28.9 (9.5) |  |
| Single |  | 196 (33.3) |  | 192 (43.0) |  | 150(41.8) |
| Working |  | 565 (96.1) |  | 378 (84.8) |  | 343(95.5) |
| PHQ-4 (Depression) | 0.97 (1.2) |  | 1.74 (1.63) |  | 1.46 (1.37) |  |
| PHQ-4 (Anxiety) | 1.06 (1.3) |  | 1.68 (1.63) |  | 1.43 (1.44) |  |
|  |  |  |  |  |  |  |
| **Desire thinking** (mean item scores) | | | | | | |
| DTQ-total | 1.16 (0.26) |  | 2.05 (0.65) |  | 1.18 (0.28) |  |
| Imaginal | 1.25 (0.37) |  | 1.82 (0.65) |  | 1.16 (0.32) |  |
| Verbal | 1.07 (0.23) |  | 2.28 (0.83) |  | 1.20 (0.31) |  |
|  |  |  |  |  |  |  |
| DTQ-r-total | 1.17 (0.27) |  | 2.05 (0.65) |  | 1.19 (0.28) |  |
| Imaginal | 1.29 (0.41) |  | 1.76 (0.66) |  | 1.22 (0.34) |  |
| Verbal | 1.07 (0.23) |  | 2.28 (0.83) |  | 1.16 (0.32) |  |
|  |  |  |  |  |  |  |
| **Addictive behaviours** |  |  |  |  |  |  |
| AUDIT | 7.0 (4.3) |  |  |  |  |  |
| FTND |  |  | 3.9 (2.4) |  |  |  |
| Problematic social media use |  |  |  |  | 36.94 (15.69) |  |

*Note*. PHQ-4 = Patient Health Questionnaire-4, DTQ = Desire Thinking Questionnaire, DTQ-r = Desire Thinking Questionnaire-Revised, AUDIT = Alcohol Use Disorders Identification Test, FTND = Fagerström Test of Nicotine Dependence.

Table 2

Principal components analysis of the DTQ.

|  |  |  |
| --- | --- | --- |
| *Verbal perseveration (VP)* | VP | IP |
| 6. When I begin to think about the desired activity I continue until I manage to engage in it  Jeg fortsetter å tenke på aktiviteten jeg har lyst på, helt til jeg kan utføre den | **.93** |  |
| 10. My mind is focused on repeating what I desire till I manage to satisfy it  Tankene mine repeterer det jeg har lyst på helt til jeg klarer å tilfredsstille dette ønsket | **.89** |  |
| 5. When I begin to think about the desired activity I find it difficult to stop  Når jeg begynner å tenke på aktiviteten jeg har lyst på, så opplever jeg det vanskelig å stoppe | **.84** |  |
| 7. I repeat mentally to myself that I need to practice the desired activity  Jeg gjentar i hodet mitt at jeg må utføre aktiviteten jeg har lyst på | **.77** |  |
| 4. If I did not practice the desired activity for a long time, I would think about it continuously  Om jeg ikke utførte aktiviteten som jeg har veldig lyst på over en god stund, så ville jeg tenkt på det hele tiden | **.75** |  |
| *Imaginal prefiguration (IP)* |  |  |
| 8. I begin to imagine the desired activity every time it comes to my mind  Jeg begynner å forestille meg aktiviteten jeg har lyst på, hver gang tanken om den dukker opp i hodet mitt | **.68** | .24 |
| 2. I imagine how I would feel like when engaging in the desired activity  Jeg forestiller meg hvordan jeg vil føle meg når jeg utfører aktiviteten som jeg har veldig lyst på |  | **.87** |
| 3. I anticipate the sensations I would feel practicing the desired activity  Jeg ser for meg sensasjonene jeg vil oppleve når jeg gjør aktiviteten |  | **.83** |
| 1. I imagine myself doing the desired activity  Jeg forestiller meg at jeg utfører aktiviteten som jeg har veldig lyst på |  | **.76** |
| 9. I imagine myself involved in the desired activity as if it were a movie  Jeg forestiller meg selv i aktiviteten jeg har lyst på som om det var en film | .21 | **.42** |

*Note*. Side loadings above .10 are displayed. bold type = DTQ-revised factors. KMO = .890, Bartlett’s test of sphericity, *p* <.001.

Table 3

Pearson’s bivariate correlations between desire thinking, depression, anxiety, and addictive behaviours.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sample 1 – AUDIT | | | | Sample 2 – FTND | | | | Sample 3 – PSMU | | | |
|  | 2 | 3 | 4 | 5 | 2 | 3 | 4 | 5 | 2 | 3 | 4 | 5 |
| 1. IP | .47\* | .26\* | .29\* | .43\* | .43\* | .09 | .16\* | .29\* | .52\* | .10 | .15\* | .34\* |
| 2. VP |  | .16\* | .12\* | .37\* |  | .09 | .17\* | .58\* |  | .14\* | .27\* | .54\* |
| 3. Depression |  |  | .69\* | .15\* |  |  | .67\* | .13\* |  |  | .61\* | .32\* |
| 4. Anxiety |  |  |  | .14\* |  |  |  | .14\* |  |  |  | .40\* |
| 5. Addiction |  |  |  |  |  |  |  |  |  |  |  |  |

*Note*. AUDIT = Alcohol Use Disorders Identification Test, FTND = Fagerström Test of Nicotine Dependence, PSMU = Problematic Social Media Use, VP = verbal perseveration, IP = imaginal prefiguration. \* *p* < .01

Table 4

Regression analyses using verbal perseveration and imaginal prefiguration as predictors of problem drinking, nicotine dependence, and problematic social media use

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | AUDIT | | FTND | | PSMU | |
| *Step* | Adj R2 | R2 cha | Adj R2 | R2 cha | Adj R2 | R2 cha |
| 1. Demographics | .14 | .15\*\* | .08 | .09\*\* | .08 | .09\*\* |
| 2. Neg. affect | .14 | .00 | .09 | .02\*\* | .19 | .12\*\* |
| 3. IP | .26 | .12\*\* | .18 | .08\*\* | .26 | .07\*\* |
| 4. VP | .29 | .03\*\* | .36 | .19\*\* | .39 | .13\*\* |
|  |  |  |  |  |  |  |
| *Last step of the equation* | | | | | | |
|  | *β* | *p* | *β* | *p* | *β* | *p* |
| Sex | -.24 | <.001 | -.10 | .012 | .04 | .328 |
| Age | -.20 | <.001 | .19 | <.001 | -.13 | .005 |
| Civil status | -.05 | .218 | -.01 | .833 | -.06 | .166 |
| Work status | .04 | .320 | -.02 | .649 | .04 | .424 |
| Depression | -.01 | .792 | .07 | .166 | .13 | . 016 |
| Anxiety | -.01 | .821 | .00 | .966 | .16 | .004 |
| IP | .27 | <.001 | .06 | .022 | .06 | .197 |
| VP | .21 | <.001 | .51 | <.001 | .43 | <.001 |

*Note*. AUDIT = Alcohol Use Disorders Identification Test, FTND = Fagerström Test of Nicotine Dependence, PSMU = Problematic Social Media Use, VP = verbal perseveration, IP = imaginal prefiguration. Demographic variables were coded as follows; Sex (male = 1 , female = 2), work status (working/studying = 1, unemployed = 2), and for civil status (single = 1, not single = 2).