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Trans-diagnostic measurement of impulsivity and compulsivity: A review of self-report tools

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Abstract

Introduction—Impulsivity and compulsivity are important constructs, relevant to understanding behaviour in the general population, as well as in particular mental disorders (e.g. attention deficit hyperactivity disorder, obsessive-compulsive disorder). The current paper provides a narrative review of self-report impulsivity and compulsivity scales.

Methods—A literature search was conducted using the following terms: (“impulsivity” OR “compulsivity”) AND (“self-report” OR “questionnaire” OR “psychometric” OR “scale”).

Results—25 impulsive and 11 compulsive scales were identified, which varied considerably in psychometric properties, convenience, and validity. For impulsivity, the most commonly used scales were the BIS and the UPPS-P, whilst for compulsivity, the Padua Inventory was commonly used. The majority of compulsivity scales measured OCD symptoms (obsessions and

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compulsions) rather than being trans-diagnostic or specific to compulsivity (as opposed to obsessions). Scales capable of overcoming these limitations were highlighted.

Discussion—This review provides clarity regarding relative advantages and disadvantages of different scales relevant to the measurement of impulsivity and compulsivity in many contexts. Areas for further research and refinement are highlighted.

Keywords

Impulsivity; Compulsivity; Trans-diagnostic; Transdiagnostic; Phenotype; Questionnaire; Self-report; Review

1 Introduction

Impulsivity and compulsivity are important concepts that are implicated in a number of recognised conditions, as well as being relevant to understanding day-to-day behaviour.They can be measured using various methodologies, but self-report questionnaires are potentially rapid to administer, can be undertaken without supervision, are often free or inexpensive, and can provide rich data (rather than a single outcome measure).In terms of measures of self-regulation, self-report measures were found to have higher reliability than cognitive tests (Enkavi et al., 2019).Impulsivity can be broadly defined as behaviours or actions that are inappropriate, premature, unduly thought out, and risky/hasty,leading to untoward outcomes (Evenden, 1999). Compulsivity can be broadly defined as a tendency towards repetitive, habitual actions, which an individual feels compelled to perform, and are repeated despite adverse consequences (for detailed discussion see Luigjes et al., 2019). Impulsive symptoms are included in the diagnostic criteria for a number of conditions in the Diagnostic and Statistical Manual Version 5 (DSM-5). One key example is attention-deficit hyperactivity disorder (ADHD), which affects 7% of children and 2.5% of adults (Thomas et al, 2015; Kessler et al, 2006), but others include borderline personality disorder and impulse control disorders. Compulsivity is an important component in a range of conditions, such as alcohol use disorder (Modell et al, 1992), anorexia nervosa (Godier & Park, 2014), trichotillomania and body dysmorphic disorder (Chamberlain et al, 2018; Ferrão et al, 2009), but the archetypal compulsive condition is regarded to be obsessive-compulsive disorder (OCD). OCD is the world's fourth most common psychiatric disorder affecting between 2% and 3% of people (Brem et al, 2014). Clinically, disorders with impulsive and compulsive symptoms negatively affect quality of life, impairing professional, personal and social wellbeing (Hollander et al, 2016, Jain et al, 2017) and constitute a significant economic cost. For example, it was estimated that OCD cost $8.4 billion in the USA in 1990, while ADHD costs around $255 billion per year in the USA (DuPont et al, 1995; Doshi et al, 2012).

The diagnosis of mental health disorders is challenging due to the heterogeneity of phenotypes, potential comorbidities and the categorical boundaries for disorders (Robbins et al, 2012). At present, a categorical approach to diagnosis is used, whereby a minimum number of criteria for a given disorder must be met before diagnoses are made. Both the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the International Classification of Diseases 11th revision (ICD-11) adhere to a categorical approach, albeit acknowledging the potential utility of complementary dimensional approaches. Dimensional

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approaches may offer advantages in terms of helping to understand, across conventionally separate disorders, common aetiological processes (e.g. in terms of genetics, or neurobiology), as well as in terms of identifying trans-diagnostic treatments and understanding treatment response or resistance across conditions. Potential value of the dimensional approach has been discussed in detail, for example in the context of the RDoC initiative (Cuthbert & Insel, 2013).Impulsivity and compulsivity are excellent candidates for dimensional modelling, as they are present in background populations but, in extreme forms, can be components in a number of clinical disorders, such as ADHD, OCD, substance use disorders and behavioural addictions (Chamberlain et al, 2019, Ioannidis et al, 2019, Brooks et al, 2017, Berlin and Hollander, 2014; Chambers & Potenza, 2003; Mestre-Bach et al, 2020). Partly as a result of this, they have received growing research interest in recent years (Figure 1 and 2). Latent impulsivity and compulsivity phenotypes could be utilised, not only to inform and direct research, but also to identify people who are at risk of developing clinical disorders in the background, potentially leading to early, preventative interventions (Parkes et al, 2019; Tiego et al, 2018).

There are a number of ways to measure impulsivity and compulsivity. Within the current categorical system, diagnostic clinical interviews are used to identify impulsive and compulsive symptoms within specific disorders. Although widely used for clinical populations they are generally not appropriate for identifying subclinical levels of impulsivity and compulsivity within the general population. For example, for an individual who has compulsive tendencies but does not have formal OCD, a diagnostic interview for OCD (such as in the Mini International Neuropsychiatric Inventory, Sheehan et al, 1998), will generally yield “no” as the outcome measure; and completion of the gold standard symptom severity tool, the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS, Goodman et al, 1989) would yield “zero”, as high compulsivity would not necessarily lead to symptoms of OCD. The information provided by these measures rules out the disorder, but offers no useful information about dimensional, trans-diagnostic compulsivity, which could then be used for the purposes of scientific investigation or to inform the treatment of other current disorders.

This review will focus on self-report questionnaires as a way of measuring impulsivity and compulsivity dimensionally. Questionnaires can be cost-effective, quick to administer, and are the most widely used method of measuring these behavioural traits (Paulhus & Vazire, 2007). They can be conducted in-person or remotely (i.e. via the Internet) and can provide information on experimentally unobserved behaviours. They have a major advantage over yes/no diagnostic interviews in that they can measure continuous constructs in normative samples as well as in clinical (and at-risk) populations. Cognitive tasks provide a different method of measuring distinct facets of impulsivity and compulsivity. Both methods (self-report questionnaires and cognitive tasks) have their own strengths and weaknesses (Cyders & Coskunpinar, 2011), however, the scope of this review is limited to self-report measures (for existing reviews of cognitive measures see Bari and Robbins, 2013; van Timmeren et al, 2018; Fineberg et al, 2014; Rochat et al, 2018; Hamilton et al, 2015a; Hamilton et al, 2015b). Self-report questionnaires have been found to be more strongly related to overt behaviour than cognitive tests, at least when administered over the Internet (Eisenberg et al, 2019).

Extensive tiers of literature indicate that impulsivity and compulsivity are fundamentally linked to the structure and function of fronto-striatal brain circuitry, albeit typically considered at the level of specific disorders (e.g. OCD, ADHD) rather that trans-diagnostically. Whereas the basal ganglia (especially putamen/caudate and nucleus accumbens) are thought to play a role in habit generation and propensity for reward-seeking, the cortices (especially frontal lobes) play a role in being able to exert top-down control over these urges and habits, in order to dampen down impulsive and compulsive tendencies (Graybiel & Rauch, 2000; Chamberlain et al., 2005; Arnsten & Rubia, 2012; Cortese et al., 2012; Fineberg et al., 2014; Hu et al., 2017).

An important theoretical consideration is whether each type of impulsivity and compulsivity have distinct subdomains. Different researchers in diverse fields have proposed various subtypes of impulsivity – such as a tendency towards disinhibited motor responses (response disinhibition, also known as ‘impulsive action’), lack of persistence (i.e. excessive behavioural ‘switching’), or reward dysfunction (such as preference for more immediate rewards rather than a larger delayed reward, referred to as impulsive choice). Much of the background literature of relevance to the debate, including from pre-clinical work, is discussed in detail in Evenden et al. (1999). More recently, using a range of impulsivity measures in a large sample of young adults, the best fit structural model (of those considered) identified three types of impulsivity: impulsive action, impulsive choice, and impulsive personality (i.e. reflecting self-reported ability to regulate one’s own behavior) (MacKillop et al., 2016). To date, for the most part compulsivity has been considered to be a unitary concept when viewed trans-diagnostically, though relatively separable domains of compulsive symptoms exist for OCD, based on factor analyses: such as repetitive ordering/counting versus hoarding versus cleaning (e.g. Stewart et al., 2008). However, factor analysis of latent symptom domains for OCD have yielded mixed findings with unacceptable model fit in some cases (Summerfeldt et al., 2001). Furthermore, many of these OCD symptom domain constructs have no or negligible relevance to other compulsive disorders – e.g. gambling disorder, or substance use disorders. Overall then, diverse sub-components of impulsivity have been proposed whereas very little is known about sub-components of compulsivity, in a trans-diagnostic sense. Accordingly, it is timely to consider the current state of the art in terms of self-report measurement tools. In turn, it is hoped this will lead to improved models of impulsivity and compulsivity; as well as understanding of their neurobiological and genetic substrates.

This paper aims to provide a useful overview of trans-diagnostic self-report measurement tools for impulsivity and compulsivity, within the framework of a narrative review. A range of self-report measures will be evaluated.A narrative review methodology was chosen for two reasons. Firstly, the heterogeneity and volume of literature, particularly on impulsivity, is vast and therefore a systematic review would be unwieldy and extremely lengthy. Secondly (and relatedly), narrative reviews allow literature to be distilled in a convenient form incorporating experts’ experiences in the field. This is important for fields that are nascent, such as trans-diagnostic compulsivity.

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2 Methods

A literature search was conducted in August 2020 using the PubMed database. The search string consisted of the following terms: (“impulsivity” OR “compulsivity”) AND (“self-report” OR “questionnaire” OR “psychometric” OR “scale”). The search resulted in 3859 articles.Key articles, books and reviews were identified and the reference lists screened for further relevant papers or additional scales. When a relevant questionnaire was identified, PubMed was again searched using the name and abbreviation of the identified questionnaire, for thoroughness.The most recent version of the questionnaire was included, unless previous versions were also in common use. Data papers were included if they were written in English, in a peer-reviewed journal, and described a questionnaire measuring impulsivity and/or compulsivity in a dimensional fashion.

Identified scales were then described in tabular summary form, in terms of their factor structure, validation studies, and the domains/types of impulsivity and compulsivity assessed according to the authors. Findings were then condensed into a convenient summary table that used a colour code to signal the extent of validation/quality (focusing on: internal consistency, test-retest reliability, factor structure, convenience, and availability for use). The items were coded as follows: for internal consistency, Cronbach’s alpha ≥0.90 was deemed good, ≥0.70 deemed acceptable, 0.65-0.69 deemed minimally acceptable, <0.65 deemed unacceptable (DeVillis, 1991). Internal consistency scores are included for subscales where these are widely used or recommended. For test-retest correlation coefficients: ≥0.70 deemed acceptable, 0.6-0.7 deemed questionable, <0.5 deemed poor (Hays et al, 1993). For scale length, <20 items was deemed good, 20-30 items was deemed mid-length and >30 items was deemed long. For factor analysis, exploratory factor analysis (EFA), followed by confirmatory factor analysis (CFA), completed on separate populations with no contradictory findings and supported by fit statistics was deemed to be good. Factor analysis completed, either one of CFA, EFA, PLS or two types completed on the same population was deemed to be minimally acceptable. An unclear or contradictory factor structure was deemed to be questionable.

3 Results

We found 25 self-report scales and subscales measuring an aspect of impulsivity. Table 1 provides a list of scales, a general description and validation measures for each scale, as well as the type of impulsivity assessed according to the authors of the scale development papers.

A list of compulsivity self-report measures is shown in Table 2. Eleven compulsivity self-report measures are presented with a general description and their validation information. Eight of these measures were developed specifically to measure symptoms of OCD according to the authors of the corresponding papers and are included because symptoms are assessed on a dimensional scale.Three scales sought to quantify compulsivity itself rather than measuring OCD symptoms.

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Table 3 summarises the validity, reliability and factor structure of the impulsivity and compulsivity self-report measures. Figure 3 lists the recommended measures for future studies. The findings are interpreted in the discussion.

4 Discussion

This review identified potential trans-diagnostic impulsivity and compulsivity self-report measures available in the literature. Figure 4 provides a working model of processes underlying these constructs based on this literature review. A number of self-report questionnaires for quantifying each construct were identified, with some being more relevant for identifying latent phenotypes than others. Questionnaires for the quantification of impulsivity were far more numerous than those for compulsivity. There may be a number of reasons for this. Impulsivity has so far received more research attention than compulsivity (Chamberlain et al, 2016), undoubtedly leading to more questionnaire development as further research is produced and definitions change. Furthermore, there is quite an extensive literature over at least 50 years concerning impulsivity and its facets (Rochat et al, 2018; MacKillop et al, 2016; Stanford et al, 2009). By contrast, even the idea of measuring compulsivity as a trans-diagnostic construct is relatively new (Chamberlain and Grant, 2018).

In relation to the impulsivity questionnaires, although there has been some agreement that impulsivity is a valuable, multidimensional concept (MacKillop et al, 2016; Fineberg et al, 2014), there is less consensus on underpinning domains. This is evident in the wide variety of approaches used by questionnaires identified in this review. For example, some authors include sensation seeking as a type of impulsivity (UPPS Impulsive Behaviour Scale (UPPS-P)) whilst others believe this is a distinct but related concept (MacKillop et al, 2016).The concept of motor impulsivity (excess motoric activity) is also separated from other cognitive aspects by a number of questionnaires (e.g. Barratt Impulsivity Scale (BIS), Recent Rash Impulsivity Scale (RRIS), and Trait Rash Impulsivity Scale (TRIS)) but not by all (e.g. UPPS-P).

Given the evidence that impulsivity is multidimensional, we believe that future research should preferentially use scales designed to account for broader frameworks of the implicated composite domains. Scales such as the UPPS-P and the Short UPPS-P (S-UPPS) fit this criterion and evidence supports their 5-factor structures, with the benefit of the S-UPPS being that it is shorter and more convenient. Nonetheless, these questionnaires would benefit from further evidence of factor structure and test-retest validation. A hierarchical model with three-higher order factors provided a good fit to data obtained from the S-UPPS-P: 1) Emotion-Based Rash Action subsuming Negative and Positive Urgency consistent with ‘Urgency’ theory (Cyders & Smith, 2008; Smith & Cyders, 2016); 2) Deficits in Conscientiousness, incorporating Lack of Perseverance and Lack of Premeditation, and 3) a distinct Sensation Seeking factor (Cyders et al., 2014).Additionally, both UPPS-P and S-UPPS scales are easily accessible and free for research purposes and have demonstrated good internal consistency scores (Table 3). The BIS is the most widely used impulsivity scale identified herein and has also shown good internal consistency scores.However, the factor structure of the BIS has been somewhat inconsistent across studies and populations

(Table 1) and Steinberg et al. (2013) demonstrated in their study that most items of the BIS-11 fail to reliably measure a cohesive impulsivity construct. These authors have recommended the use of the 8-item BIS-Brief in place of the BIS-11.

Turning now to the compulsivity questionnaires identified in this review, it is noteworthy that the majority of these instruments specifically assess OCD symptoms – understandably so, since they were developed to explore OCD, not with the intention of measuring compulsivity trans-diagnostically. Of OCD dimensional questionnaires, the Padua Inventory, and Obsessive Compulsive Inventory-Revised (OCI-R), are sound options for OCD-related research in view of their psychometric and other properties. Of the two, the OCI-R is shorter and therefore more convenient. A revised version of the Padua, the Padua Inventory – Washington State University Revision (PI-WSUR), is also a good option for assessing OCD symptoms as it has demonstrated excellent reliability estimates in a recent meta-analysis, especially when considering total scores (Rubio-Aparicio et al, 2020).Such OCD-specific questionnaires are extremely useful for studying OCD dimensionally (both in clinical and general population settings), but cannot provide a truly trans-diagnostic measure of compulsivity for two reasons: first, they encompass obsessions as well as compulsions; second, they were never designed for the purposes of trans-diagnostic measurement: the questions were specifically designed to identify OCD symptoms.They also identify underlying factors of OCD symptoms – such as compulsive washing/checking, obsessive thoughts of self-harm, or contamination obsessions. These symptom domains are not generally relevant to the many other forms of compulsivity – e.g. gambling disorder, substance use disorder, or hair pulling disorder. By contrast, other questionnaires – specifically the Cambridge-Chicago Compulsive Trait Scale (CHI-T; Albertella, Chamberlain, Le Pelley et al, 2019) and Brief Assessment Tool for Compulsivity Associated Problems (BATCAP; Albertella, Le Pelley, Chamberlain et al, 2019) – were designed to assess compulsivity across disorders. Scores on the CHI-T show convergent validity against clinical instruments measuring different compulsive symptoms including gambling, OCD, and substance use disorder (across different types of substance) (Chamberlain & Grant, 2018), whilst the BATCAP can be modified to suit different disorders of interest.The CHI-T and the BATCAP are recently developed and, like many of the scales discussed in this review, would benefit from further validation.

Whereas the underlying domains of impulsivity have been widely explored, the notion of teasing apart trans-diagnostic component underpinnings of compulsivity has received relatively little research attention. Initial factor analysis of the CHI-T suggested two factors: one relating to reward and the need for perfection, the other relating to anxiolytic/soothing features (Chamberlain & Grant, 2018). Recent analysis in a large sample of >40,000 participants indicated three components as being important for CHI-T compulsivity: perfectionism, reward seeking, and habit (Hampshire et al., 2020).It should be noted that a number of other scales have been developed with a view to measuring habit, but not compulsivity *per se* (Ersche et al, 2017; Zmigrod et al, 2018; Verplanken and Orbell, 2003; Piquet-Pessoa et al, 2019). In the well-established neurobiological model, OCD is conceptualized as a habit disorder (involving excessive basal ganglia input and reduced top-down control) (Graybiel and Rauch, 2000; Chamberlain and Menzies, 2009). Future work should test contributors to trans-diagnostic compulsivity (reward seeking, perfectionism, and

habit) at several levels: brain structure/function, psychological processes, and cognition. This may yield biological models akin to the earlier OCD model that can be applied across disorders.

Our review of the research literature revealed several deficient practices in determining the factorial structure of impulsivity and compulsivity questionnaires, which has contributed to the lack of clarity regarding the dimensionality of these constructs. First, PCA is not a recommended approach for uncovering the optimal latent structure of psychometric instruments (Costello & Osborne, 2005; Howard, 2018). PCA is a data reduction technique that confounds common and unique sources of variance in measured variables (i.e. item response variables), such that the results do not represent true factors (Howard, 2018). Second, when EFA has been used,scale items have been removed based on quite stringent, and somewhat arbitrary, empirical criteria (primary loadings >.5), where more lenient thresholds have been more recently recommended (Costello & Osborne, 2005; Hair, Black, Babin, & Anderson, 2014; Howard, 2018). Removal of items based solely on empirical criteria can also reduce the construct coverage of the scale or subscales leading to the '*attenuation paradox*', whereby the criterion-related validity of the instrument is compromised (Bandalos, 2018; Loevinger, 1954). Third, evidence of model misspecification in studies using CFA studies based on the chi square test statistic (i.e. χ^2, $p < .05$) are routinely ignored, despite strong advice to the contrary (Barrett, 2007; Hayduk, Cummings, Boadu, Pazderka-Robinson, & Boulianne, 2007). Alternatively, researchers have referred to approximate fit indices, such as the root mean square error of approximation (RMSEA), comparative fit index (CFI), and standardised root mean residual (SRMR), to adjudge model fit. However, guidelines recommended against using decision rules based on arbitrary thresholds for approximate fit indices (Barrett, 2007; Hayduk et al., 2007; Kline, 2015).

We suggest that widespread evidence of model misspecification and inconsistency across studies reflects attempts to fit the data to independent clusters models. CFA using an independent clusters model (ICM) imposes unrealistic restrictions on model parameters by constraining non-target loadings and error covariances to zero (Marsh et al., 2010, 2014). These restrictions are potentially problematic in the current context because subscales measuring symptoms of psychopathology are likely to exhibit strong empirical overlap attributable to method variance, item characteristic, and item context effects (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). There are likely to be local item dependencies due to similar content/wording, as well as sample-specific systematic and random variance that leads to covariance between items. It is not uncommon for CFA-ICM models to provide a very poor fit to the data, even for established constructs, such as the Big Five personality traits (Marsh et al., 2010). We suggest that a more viable approach to modelling impulsivity and compulsivity questionnaire data is to use exploratory structural equation modelling (ESEM) and / or Bayesian SEM [BSEM] (Asparouhov & Muthén, 2009; Marsh et al., 2014). ESEM represents a synthesis of exploratory and confirmatory factor analytic approaches, enabling evaluation of model fit whilst also accommodating item cross-loadings (Asparouhov & Muthén, 2009; Marsh et al., 2014). Bayesian SEM can accommodate item cross-loadings and error covariances through the specification of model priors (Muthen & Asparouhov, 2012; Zyphur & Oswald, 2013). BSEM is particularly useful for incorporating evidence from previous studies into the analytic procedure through specification of model

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priors for factor loadings and factor covariances, which facilitates synthesis and evaluation of empirical evidence across independent studies (Muthen & Asparouhov, 2012; Zyphur & Oswald, 2013). Item response theory (IRT) is another approach that would be useful in the evaluation and refinement of impulsivity and compulsivity questionnaires (Edelen & Reeve, 2007; Reise & Rodriguez, 2016). IRT involves the application of measurement models that enable the relation between item-level responses and the underlying construct to be evaluated at a group or individual level (Reise et al., 2005; Reise & Waller, 2009). Multi-dimensional IRT has already been successfully applied to evaluation and refinement of the BIS-11, leading to development of the BIS-Brief (Steinberg et al., 2013).

This review brings to the fore several key questions: what is the relationship between self-report (i.e. 'subjective') measures of impulsivity/compulsivity and so-termed 'objective' measures of clinical interview and cognitive tests? Can generalisations be made about the relative reliability of different types of measure? And, how do the subjective impulsivity/compulsivity measures relate to well-being and brain imaging markers? Clearly, having high subjective levels of impulsivity and/or compulsivity does not necessarily mean that clinical interview diagnostic criteria for a given impulsive/compulsive disorder would be met. Logically, it would be unusual/rare to have low subjective levels of impulsivity/compulsivity but to have one or more related mental disorders (e.g. ADHD, OCD). One interpretation is that subjective ratings of impulsivity and compulsivity exist on dimensions or continua between the general population and people with mental disorders; those individuals with mental disorders are typically at the upper end of these continua on subjective rating scores. Viewed this way, dimensional subjective scores could reflect propensity to develop disorders at some point in life; i.e. candidate vulnerability markers. As such, broadly speaking we recommend the same self-report scales be used in general population studies as in clinical (i.e. patient) studies. That being said, more specialised additional scales can be useful in clinical settings, such as for screening of particular disorders, and establishing disease severity. In terms of the relationships between subjective measures and cognitive measures, these appear to operate at different levels. Studies indicate that self-report measures can be more sensitive to impulsive-compulsive pathologies than cognitive tests, both at the level of the general population, and in patient settings such as OCD (Eisenberg et al, 2019; Frydman et al., 2020). In a meta-analysis of 27 research papers, the relationship between self-report and cognitive measures of impulsivity was statistically significant but small (r=0.097) (Cyders & Coskunpinar, 2011). Thus, self-report and cognitive measures are relatively separate from each other, indicating that inclusion of both types can be helpful, in order to maximally understand the concepts. In terms of relative reliability, a recent excellent review found that self-report measures of self-regulation, overall, had higher test-retest reliability than behavioural measures (Enkavi et al., 2019). This was found to be attributable to higher between-subject variance for self-report measures versus task measures, and fits with the notion that self-report questionnaires capture relatively richer data. Note should be given though to the test-retest (and other properties) of specific scales and cognitive tests, when selecting them for studies.

In terms of well-being, latent phenotypes of impulsivity and compulsivity (constructed from a range of self-report, clinical, and cognitive measures) were significantly associated with worse quality of life in a general population sample of young adults (Chamberlain et al.,

2018). Interestingly, some aspects of personality relevant to compulsivity may in fact have advantages in terms of resilience in the face of adversity, notably ‘conscientiousness’ and ‘perfectionism’ (Chamberlain & Grant, 2019; Hampshire et al., 2020).

In terms of brain biology, impulsive and compulsive problems often co-present in the same individual, which may indicate some degree of common dysregulation of fronto-striatal circuitry. It has been previously suggested that impulsivity and compulsivity might constitute opposite ends of a single continuous dimension (Stein et al, 1993), but this has since been questioned as impulsivity and compulsivity commonly co-occur in the same individual (Chamberlain et al, 2018), share high familial overlap, and are both characterised by a subjective feeling of a “lack of control” (Fineberg et al, 2014).As can be seen in Table 1 and Table 2, rarely have both impulsivity and compulsivity been encapsulated within a single instrument. The exception to this is the Impulsive-Compulsive Behaviours Checklist (ICBC; Guo et al., 2017), which assesses for the presence of 33 impulsive and compulsive behaviours, with each behaviour rated from it never being a problem through to always being a problem. In recent work, it has been shown that responses on the ICBC were optimally explained by a bi-factor model, in which most of the explained variance (~70%) was accounted for by a general factor of ‘disinhibition’ with there being additional residual factors of ‘impulsivity’ and ‘compulsivity’. Such bi-factor modelling then yields dimensional scores for these factors. It has been shown that impulsivity and compulsivity, modelled thusly, have different antecedents longitudinally, such as parenting and childhood experiences of friendships (Chamberlain et al., 2019). In follow-up work, it was found that disinhibition was associated with reductions of cortical grey matter thickness, coupled with excessive intra-cortical myelination, indicative of disruptions of cortico-cortical communication tracts (Romero-Garcia et al., submitted 2019). Put differently, changes in cortical architecture (especially but not only in bilateral frontal cortices) statistically accounted for the expression of 33 impulsive and compulsive problems, indicating a common vulnerability marker for both types of symptoms trans-diagnostically.

This review highlights the importance of using appropriate self-report questionnaires to measure impulsivity and compulsivity. Using measures with demonstrable validity, reliability and structure will strengthen research findings, ultimately leading to a greater understanding of these tendencies, which are highly relevant for a range of disorders, but also to understanding day-to-day behaviour. Because self-report questionnaires yield stronger relationships to observed behaviour than cognitive measures (Eisenberg et al, 2019), we highlight the importance that cognitive research also includes such self-report measures: questionnaires should not be viewed as alternatives to cognitive tests of impulsivity/compulsivity, nor *vice versa*. It should also be borne in mind that questionnaires and cognitive tasks also operate at different levels of measurement: understanding behaviour is likely to need different, complementary vantage points.

Although this is, to our knowledge, the only available narrative review to date surveying impulsive and compulsive self-report scales collectively, several limitations should be considered. Firstly, this is a narrative review rather than a systematic review. This approach was chosen due to the large heterogeneity of impulsivity and compulsivity definitions making systematic inclusion and exclusion of scales less attractive and potentially

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introducing bias in the presented output; and also so that the experience of the authors could be used to distil the literature.The paper does include many of the core elements of a systematic review, including a clear search strategy and explicit criteria for inclusion and quality.Nonetheless, future work should consider undertaking systematic reviews in this field, and the limitations of a narrative approach should be noted. Secondly, we focused only on papers and measures written in English and did not explore grey literature. Thirdly, by necessity, some thresholds for determining questionnaire validation/quality were somewhat arbitrary, since no consensus exists on where to draw such limits, however, many of the metrics used (e.g. Cronbach's alpha or test-retest coefficients) are well established. Our intent in taking this approach was to make the review maximally useful for readers by presenting a colour-coded overview of questionnaire properties. Lastly, our search criteria did not capture some types of scale, such as the Affective Reactivity Index (Stringaris et al., 2012). Affective reactivity and emotional dysregulation are very relevant to impulsivity; and are to some extent captured by other scales such as the UPPS. Despite these limitations, this review offers a comprehensive and useful overview of the available impulsivity and compulsivity self-report measures.

Future research should focus on further validating existing questionnaires, especially recent questionnaires that have yielded promising biological findings but have not yet been fully validated, although it is important that validation of all questionnaires is continually revisited and updated where appropriate. Future studies should also focus on compulsivity research in more general terms as this review highlights the relative lack of relevant research in this area. We suggest that self-report impulsivity and compulsivity scales would benefit from inclusion in clinical trials, along with conventional outcome measures, with a view to identifying treatments capable of subverting a range of psychopathologies from current categorical classification systems. Such scales would also be beneficial to include in longitudinal cohort studies. We note that large-scale population longitudinal studies in psychiatry (e.g. Biobank, Neuroscience in Psychiatry Network [NSPN], ABCD) have typically not included trans-diagnostic self-report compulsivity measures, nor the gold-standard self-report dimensional impulsivity measures.This is understandable given the lack of availability of such instruments until recently and to some extent lack of clarity regarding the most optimal measures. We hope this narrative review clearly signals suitable tools that should be included in these and other longitudinal studies. This is vital given the prevalence of impulsive and compulsive problems and disorders; evidence that such measures can predict clinical outcomes (e.g. Mallorquí-Bagué et al., 2018); and also given that not accounting for these concepts will confound other research areas. Finally, future work should further address common and distinct biological and genetic processes contributing to both impulsive and compulsive problems, ideally across a range of self-report scales recommended for use herein.

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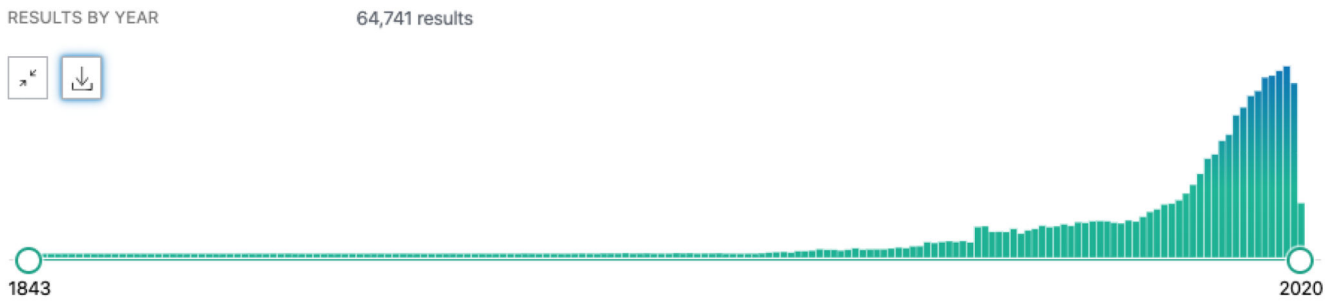

Figure 1.
Results of Pubmed search of “impulsivity” by year

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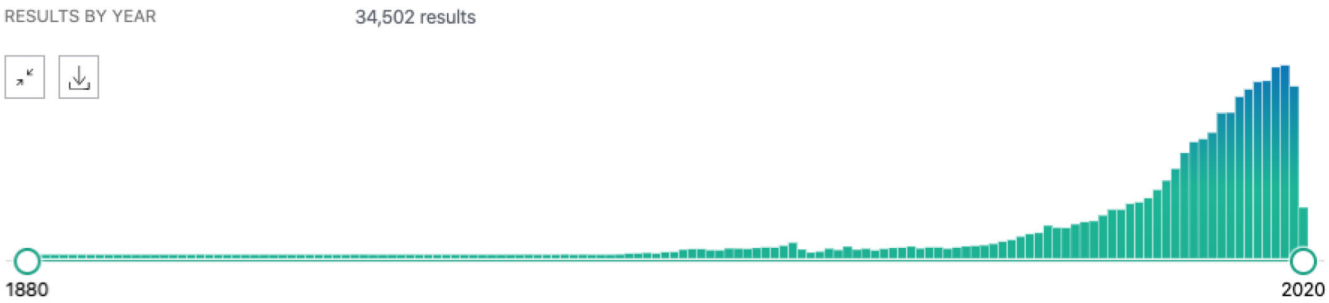

Figure 2.
Results of Pubmed search of “compulsivity’ by year

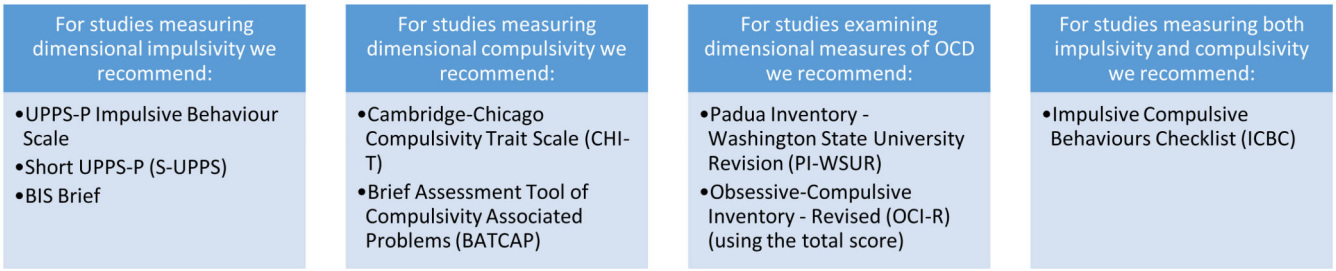

Figure 3.
Recommended impulsivity and compulsivity self-report measures

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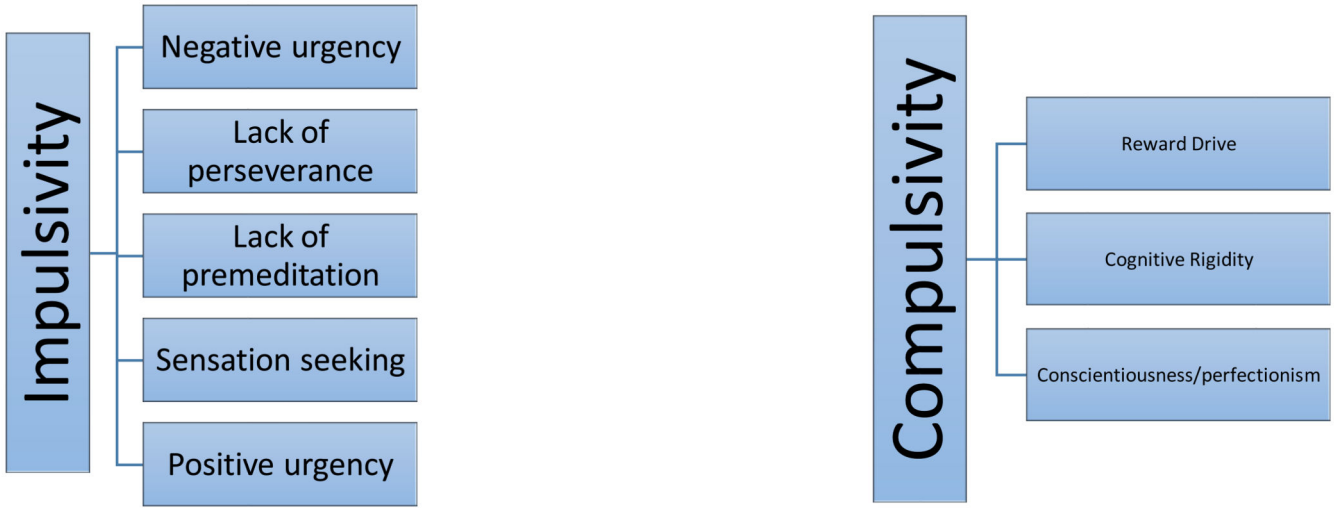

Figure 4.

Current working model of impulsivity and compulsivity. The framework for impulsivity is from (Lynam et al., 2006), using the UPPS instrument, which provides good coverage of the relevant sub-domains. The framework for compulsivity is based on (Hampshire et al., 2020), using the CHI-T. For compulsivity, while reward drive and rigidity were linked with untoward functional outcomes during COVID-19, conscientiousness/perfectionism was found to be protective (Hamprshire et al., 2020).

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Table 1

Impulsivity Scales

Questionnaire	Original Reference	General Description	Factor Structure	Validation	Type of impulsivity assessed (according to authors)
Abbreviated Impulsiveness Scale (ABIS)	Coutlee et al, 2014	13 item scale derived from the BIS-11. Higher score represents higher impulsivity.	3 factors (EFA, CFA, Coutlee et al, 2014)	Internal consistency: α = 0.71-0.88 (subscales) (Coutlee et al, 2014) Test-retest: Could not find data Healthy volunteers (Coutlee et al, 2014) Adolescents (Adjorlolo et al, 2018)	Motor impulsivity, attentional impulsivity and non-planning impulsivity (Coutlee et al, 2014)
Barkley Deficits in Executive Functioning, Self-Restraint/Inhibition Scale (BDEFS)	Barkley and Murphy, 2011	Subdomain of the BDEFS consisting of 19 questions. 4 item Likert scale ranging from Never/Rarely to Very Often.	1 factor (PCA; Barkley and Murphy, 2011; ESEM, CFA, Kamradt et al, 2019)	Internal consistency: α = 0.93 (total score) (Dehili et al, 2013) Test-retest: r = 0.63-0.80 (2-3 weeks; Allee-Smith et al, 2012) ADHD (Kamradt et al, 2014) Binge eating (Steadman and Knouse, 2016)	Self-restraint (Barkley and Murphy, 2011)
Barratt Impulsiveness Scale 11 (BIS-11)	Patton, Stanford and Barratt, 1995	30 item scale with Likert scale responses ranging from 1 (rarely/never) to 4 (almost always/always). Total score and subscale scores often used. Higher scores reflect higher impulsivity.	6 first order components, 3 second-order impulsiveness factors (PCA; Patton et al, 1995) Alternative 3 factors (CFA, Ireland and Archer, 2008; CFA, Reid et al, 2014) 2 factors (CFA, Haden and Shiva, 2009; CFA, Reise et al, 2013)	Internal Consistency: α = 0.79 (total score) (Patton et al, 1995) α = 0.64-0.71 (subscales) (Coutlee et al, 2014) Test-retest: r = 0.66-0.83 (1-6 months; Vasconcelos et al, 2012) Restrained eaters (Ebneter et al, 2012) Eating disorders and OCD (Boisseau et al, 2012) Smokers (McCarthy et al, 2016) Anxiety, depression and stress (Moustafa et al, 2017)	Motor, attentional and non-planning impulsivity (Patton et al, 1995)
Barratt Impulsiveness Scale - 15 (BIS-15)	Spinella, 2007	15 item version of the BIS. Four-point Likert scale ranging from 1 (rarely/never) to 4 (almost always/always). Higher score reflects higher impulsivity.	3 factors (PCA; Spinella, 2007)	Internal consistency: α = 0.81 (total score) (Spinella, 2007) Test-retest: r = 0.61-0.79 (6 months; Meule et al, 2015) Pornography use disorder (Antons and Brand, 2018) Community sample (Spinella, 2007) Obesity (Meule, de Zwaan and Muller, 2017)	Motor, attentional and non-planning impulsivity (Spinella, 2007)
Barratt Impulsiveness Scale – Brief (BIS-Brief)	Steinberg, Sharp, Stanford and Tharp, 2013	8 item version of the BIS-11. Four-point Likert scale ranging from 1 (rarely/never) to 4 (almost always/always). Higher score reflects higher impulsivity.	Single dimension of impulsivity (Bifactor; Steinberg et al, 2013) Single factor following modification (CFA, Fields et al, 2015) Two factors of impulsivity (EFA, CFA; Morean, DeMartini et al, 2014; CFA, Charles et al, 2019; PCA,	Internal consistency: α = 0.73-0.83 (total score, different populations) (Steinberg et al, 2013) Test-retest: r = 0.74 (1 day, Mathias et al, 2018) Borderline personality disorder, healthy controls, domestic violence offenders, adolescent and young adults (Mathias et al, 2018) Justice-involved sample (Fields et al, 2015)	Trait impulsivity (Steinberg et al, 2013) Poor Self-Regulation and Impulsive Behaviour (Morean, DeMartini et al, 2014)

Questionnaire	Original Reference	General Description	Factor Structure	Validation	Type of impulsivity assessed (according to authors)
			CFA, Dunne et al, 2018)	HIV medication non-adherence (Dunne et al, 2013)	
Behavioural Activation Scale (BAS)	Carver and White, 1994	13 item scale divided into three subscales. Responses on a 4 point Likert scale with 1 indicating strong agreement and 4 indicating strong disagreement.	3 factors (EFA, Poythress et al, 2008; CFA, Ross et al, 2002) 3 factors but not adequate fit (CFA; Cogswell et al, 2006) Single factor (EFA, CFA; Maack and Ebesutani, 2018)	Internal consistency: α = 0.87 (total score) (Cyders et al, 2007) Test-retest: r = 59-69 (two months, Carver and White, 1994) Offenders (Poythress et al, 2008) Depression (McFarland et al, 2006) Smokers (Cui et al, 2015)	Reward responsiveness, drive and fun seeking (Carver and White, 1994; Cyders et al, 2007)
Brief Sensation Seeking Scale (BSSS)	Hoyle et al, 2002	8 item scale with a 5 level Likert scale (strongly disagree to strongly agree).	Unable to find	Internal consistency: α = 0.76 (total score) (Hoyle et al, 2002) Test-retest: Unable to find Adolescents (Hoyle et al, 2002)	Sensation seeking (Hoyle et al, 2002)
Dickman's Functional and Dysfunctional Impulsivity Inventory (DII)	Dickman, 1990	23 item scale divided into two subscales with yes/no responses.	Seven factors, although two factors chosen (method not described; Dickman, 1990)	Internal consistency: α = 0.79 (functional) 0.85 (dysfunctional) (Whiteside and Lynam, 2001) Test-retest: Unable to find Internet Gaming Disorder (Na et al, 2017)	Functional and dysfunctional impulsivity (Dickman, 1990)
Eysenck's Impulsiveness, Venturesomeness and Empathy (IVE-7)	Eysenck, Pearson, Easting and Allsopp, 1985	54 question self-report measure comprising of three subscales – impulsiveness, venturesomeness and empathy. Answers are coded yes/no.	3 factors (PCA, Eysenck et al, 1985; EFA, Caci et al, 2003)	Internal consistency: α = 0.87 (impulsiveness) (Whiteside and Lynam, 2001). KR-20 = 0.624-0.819 (Caci et al, 2003) Test-retest: Unable to find Polydrug and ecstasy users (Butler and Montgomery, 2004) Schizophrenia (Kristof et al, 2018) Gambling Disorder (Leppink et al, 2016)	Impulsiveness and venturesomeness (Eysenck et al, 1985)
Impulsive Compulsive Behaviours Checklist (ICBC)	Guo et al, 2017	33 items of impulsive or compulsive behaviours measured with a 4 point Likert scale and an additional question asking if distress is caused to participant or others by the behaviour.	2 factors (EFA, CFA; Guo et al, 2017) Bifactor model of general 'disinhibition' factor and two specific factors (CFA, Chamberlain et al, 2019)	Internal consistency: α = 0.84 (Impulsive-Compulsions) 0.89 (Compulsive-Impulsions) (Guo et al, 2017) Test-retest: Unable to find Community sample (Chamberlain et al, 2019)	Impulsive and compulsive behaviours (Guo et al, 2017)
Lifetime History of Impulsive Behaviors (LHIB-Q53)	Coccaro and Schmidt-Kaplan, 2012	A 53 item self-report version of the Lifetime History of Impulsive Behaviors (LHIB) interview. Frequency of behaviours indicated across lifetime from "no events" to "more times than can be counted".	Unable to find	Internal consistency: α = 0.96 (total score) (Coccaro and Schmidt-Kaplan, 2012) Test-retest: r = 0.88 (5-69 days; Coccaro and Schmidt-Kaplan, 2012) Healthy and psychiatrically disordered subjects (Coccaro and Schmidt-Kaplan, 2012)	Lifetime occurrence of impulsive behaviours (Coccaro and Schmidt-Kaplan, 2012)
Multidimensional Personality	Tellegen, 1982	A 24 item Control subscale of the	Single factor included in the	Internal consistency: α = 0.90 (total) (Whiteside and	Lack of control (Tellegen, 1982)

Questionnaire	Original Reference	General Description	Factor Structure	Validation	Type of impulsivity assessed (according to authors)
Questionnaire Control Scale		Multidimensional Personality Questionnaire.	higher order constraint factor (Whiteside and Lynam, 2001)	Lynam, 2001) Test-retest: r = 0.82-0.92 (30 days; Peterson et al, 2010) Bulimia, Binge Eating Disorder, Obesity (Peterson et al, 2010)	
NEO-Personality Inventory-Revised (NEO-PI-R)	Costa and McCrae, 1992	Subscale of the NEO Personality Inventory Neuroticism scale.	Part of the neuroticism scale (Costa and McCrae, 1992)	Internal consistency: α = 0.63 (Impulsiveness) (Whiteside and Lynam, 2001). Test-retest: Unable to find Populations: Autism spectrum disorders (Hesselmark et al, 2015) Borderline personality disorder (Wilberg et al, 1999)	Impulsiveness (Costa and McCrae, 1992)
Personality Research Form Impulsivity Scale	Jackson, 1984	A 16 item subscale of the Personality Research Form.	Unidimensional subscale (EFA, Stricker, 1974)	Internal consistency: α = 0.81 (total score) (Whiteside and Lynam, 2001) Test-retest: Unable to find Undergraduates (Whiteside and Lynam, 2001) Alcohol addiction, (Hoffman, 1971)	Impulsivity (Whiteside and Lynam, 2001)
Positive Urgency Measure (PUM)	Cyders et al, 2007	14 item scale assessed on a four-point Likert scale ranging from 1 (agree strongly) to 4 (disagree strongly).	Unidimensional (EFA, CFA; Cyders et al, 2007)	Internal consistency: α = 0.95 (total score) (Cyders et al, 2007) Test-retest: r = 0.85 (Tested as part of UPPS-P, Weafer et al, 2013) Eating disorders, problem drinking, problem gamblers, (Cyders et al, 2007)	Positive Urgency (Cyders et al, 2007)
Recent Rash Impulsivity Scale (RRIS)	Mayhew and Powell, 2014	17 item scale developed to assess impulsive tendencies over short periods, derived from items of BIS, EASI-III, DII, I_7 and UPPS.	2 factors (EFA, CFA; Mayhew and Powell, 2014)	Internal consistency: α = 0.53-0.68 (subscales) (Mayhew and Powell, 2014) Test-retest: r = 0.54-0.65 (4 weeks, Mayhew and Powell, 2014). Undergraduates (Mayhew and Powell, 2014)	Cognitive impulsivity and motor impulsivity (Mayhew and Powell, 2014)
Risky, Impulsive and Self-Destructive Behavior Questionnaire (RISQ)	Sadeh and Baskin-Sommers, 2016	38 item scale based on frequency and age of onset of risky behaviours.	General factor and 8 specific factors (EFA, CFA, bifactor, Sadeh and Baskin-Sommers, 2016)	Internal consistency: α = 0.92 (total score) (Sadeh and Baskin-Sommers, 2016). Test-retest: Unable to find Community sample, students and veterans (Sadeh and Baskin-Sommers, 2016)	Risky and self-destructive behaviour with specific behaviour subscales (Sadeh and Baskin-Sommers, 2016)
Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ)	Torrubia et al, 2001	48 items with yes/no responses. Two 24 item subscales.	2 factors (PCA, Torrubia et al, 2001) Trimmed 2 factors although mixed support (EFA, CFA; O'Connor et al, 2004)	Internal consistency: α = 0.75-0.83 (subscales) (Torrubia et al, 2001) Test-restest: r = 0.87-0.89 (3 months; Torrubia et al, 2001) Intermittent Explosive Disorder (Torrubia et al, 2001) Gamblers (Gaher et al,	Sensitivity to punishment, Sensitivity to reward (Torrubia et al, 2001)

Questionnaire	Original Reference	General Description	Factor Structure	Validation	Type of impulsivity assessed (according to authors)
				2015) Anorexia (Glashouwer et al, 2014)	
Sensation Seeking Scale (SSS-V)	Zuckerman, 1994	40 item scale comprising 4 subscales and a total score. Forced choice answers.	4 factors (CFA; Loas et al, 2001; METHOD, Roberti et al, 2003; CFA, Haynes et al, 2000)	Internal consistency: α = 0.57-0.78 (subscales) (Whiteside and Lynam, 2001) Test-retest: r = 0.87 (4 to 6 weeks; Ballon et al, 2014) Driving behaviour (de Winter et al, 2018) Cocaine dependence and ADHD (Ballon et al, 2014)	Adventure seeking, experience seeking, disinhibition and susceptibility (Zuckerman, 1994)
Temperament and Character Inventory Impulsiveness (TCI)	Cloninger et al, 1991	8 item subscale of the novelty-seeking dimension. True or false answers.	Unidimensional (PCA; Cloninger et al, 1991)	Internal consistency: α = 0.63 (Impulsiveness subscale) (Whiteside and Lynam, 2001) Test-retest: Unable to find Depression (Nogueira et al, 2017) Schizophrenia (Guillem et al, 2002)	Impulsiveness (Cloninger et al, 1991)
Temperament and Character Inventory – Revised Impulsiveness (TCI-R)	Cloninger, 1999	9 item subscale from revised version of TCI. 5 point Likert scale (definitely false to definitely true).	Unidimensional (EFA, CFA; Farmer and Goldberg, 2008)	Internal consistency: α = 0.74 (Impulsiveness subscale) (Farmer and Goldberg, 2008) Test-retest: Unable to find Obsessive compulsive disorders and anxiety (Pelissolo et al, 2015)	Impulsiveness (Cloninger, 1999)
Trait Rash Impulsivity Scale (TRIS)	Mayhew and Powell, 2014	17 item scale derived from items of BIS, EASI-III, DII, I_7 and UPPS. Same items as RRIS but timescale removed.	2 factors (EFA, CFA; Mayhew and Powell)	Internal consistency: α = 0.73 (total score) (Mayhew and Powell, 2014) Test-retest: r = 0.65 (4 weeks, total score; Mayhew and Powell, 2014) Undergraduates (Mayhew and Powell, 2014)	Cognitive and motor impulsivity (Mayhew and Powell, 2014)
UPPS-P Impulsive Behaviour Scale	Lynam, Whiteside, Smith and Cyders, 2006	59 item scale scored on a 4 point Likert scale from 1 (agree strongly) to 4 (disagree strongly). Higher scores indicate higher impulsivity.	Five factors (CFA, Cyders and Smith, 2007)	Internal consistency: α = 0.94-0.80 (subscales) (Cyders and Smith, 2007) Test-retest: r = 0.81-0.93 (>1 day, Weafer et al, 2013) Alcohol problems (McCarty et al, 2017) Nonsuicidal self-injury (Claes and Muehlenkamp, 2013)	Negative urgency, lack of premeditation, lack of perseverance, sensation seeking and positive urgency (UPPS-R and PUM) (Lynam et al, 2006)
Short UPPS-P (S-UPPS-P)	Cyders, Littlefield, Coffey and Karyadi, 2014	Short version of the UPPS-P composed of 20 items rated on a four-point Likert scale.	Five factors (CFA; Dugre et al, 2019)	Internal consistency: α = 0.70-0.81 (subscales) (Dugre et al, 2019) Test-retest: r = 0.60 (< 30 days; Dugre et al, 2019) Binge drinking (Bø et al, 2016)	Negative urgency, lack of premeditation, lack of perseverance, sensation seeking and positive urgency (Cyders et al, 2014)
UPPS-R Impulsiveness Behaviour Scale	Whiteside and Lynam, 2001	45 item scale assessing four facets of impulsivity. Higher scores reflect higher impulsivity.	4 dimensions of impulsivity (EFA, CFA; Whiteside and Lynam, 2001)	Internal consistency: α = 0.82-0.91 (subscales) (Whiteside and Lynam, 2011) Test-retest: Unable to find Drinking behaviour (Cyders et al, 2009)	Negative urgency, lack of perseverance, sensation seeking and lack of premeditation

Questionnaire	Original Reference	General Description	Factor Structure	Validation	Type of impulsivity assessed (according to authors)
				Skin picking disorder (Snorrason et al, 2011)	(Whiteside and Lynam, 2001)

α = Cronbach's α, r = Pearson's r, KR-20 = Kuder-Richardson 20 formula. PCA = Principal Components Analysis; CFA = Confirmatory Factor Analysis; EFA = Exploratory Factor Analysis; PLS = Partial Least Squares.

Table 2

CompulsivityScales

Questionnaire	Main citation	General Description	Factor structure	Validation	Type of compulsivity assessed (according to authors)
Brief Assessment Tool of Compulsivity Associated Problems (BATCAP)	Albertella, Le Pelley et al, 2019	Trans-diagnostic questionnaire rated on a 5 point scale from 0 (none/not at all) to 4 (extreme/ constant). Questions derived from YBOCS, FOCI and PACS.	Unknown	Internal consistency: Unable to find Test-retest: Unable to find Community sample (Albertella, Le Pelley et al, 2019)	Compulsive behaviours (Albertella, Le Pelley et al, 2019)
Cambridge-Chicago Compulsivity Trait Scale (CHI-T)	Chamberlain and Grant, 2018	15 item scale covering broad aspects of compulsivity. Items scored from strongly disagree (0) to strongly agree (3).	One factor (PLS, Albertella, Chamberlain et al, 2019) Two factors (EFA, Chamberlain and Grant, 2018)	Internal consistency: α = 0.84 (total score) (Albertella, Chamberlain et al, 2019) Test-retest: Unable to find Community sample (Albertella, Chamberlain et al, 2019)	Compulsivity (Albertella, Chamberlain et al, 2019)
Compulsive Activity Checklist (CAC)	Freund, Steketee and Foa, 1987	38 items rated on a 4-point scale to measure impairment due to obsessive compulsive symptoms.	3 factors (PCA, Sternberger and Burns, 1990)	Internal consistency: α = 0.91 (total score) (Freund et al, 1987) Test-retest: r = 0.68 (average of 36 days, Freund et al, 1987) OCD (Freund et al, 1987) Community sample (Sternberger and Burns, 1987)	Obsessive-compulsive symptoms (Sternberger and Burns, 1987)
Dimensional Obsessive-Compulsive Scale (DOCS)	Abramowitz, et al, 2010	20 item scale with four dimensions: contamination, responsibility for harm, unacceptable obsessional thoughts and symmetry. Assesses symptom presence and severity. Responses on a scale from 0 to 4.	4 factors (EFA, CFA, Abramowitz et al, 2010)	Internal consistency: α = 0.83-0.96 (subscales in different populations) (Abramowitz et al, 2010) Test retest: r = 0.55-0.66 (12 weeks, Abramowitz et al, 2010) OCD and community sample (Thibodeau et al, 2015)	Obsessive-compulsive symptoms (Abramowitz et al, 2010)
Impulsive Compulsive Behaviours Checklist (ICBC)	Guo et al, 2017	33 item scale consisting of a list of behaviours with a 4 point scale used to determine frequency from Never (1) to Always (4). Respondents also indicate whether each behaviour causes them distress.	2 factors (EFA, CFA, Guo et al, 2017)	Internal consistency: α = 0.84 (Impulsive-Compulsions) 0.89 (Compulsive-Impulsions) (Guo et al, 2017 Test-retest: Unable to find Community sample (Guo et al, 2017)	Impulsive-Compulsions and Compulsive-Impulsions (Guo et al, 2017)
Obsessive-Compulsive Inventory – Revised (OCI-R)	Foa, Huppert, Leiberg, Langner, Kichic, Hajcak and Salkovskis, 2002	18 item inventory with 6 subscales rating symptom trouble during past week. Items are rated on 5 point scale between Not at all (0) and Very much (4).	6 factors (PCA, Foa et al, 2002)	Internal consistency: α = 0.34-0.93 (subscales) (Foa et al, 2002) Test retest: r = 0.57-0.87 (1-2 weeks, Foa et al, 2002) Post-Traumatic Stress Disorder, OCD, Generalised Social Phobia (Foa et al, 2002)	Symptoms of Obsessive-compulsive disorder (Foa et al, 2002)
Padua Inventory (PI)	Sanavio, 1988	60 item scale rated on a 5-point scale from 0 (not at all disturbing) to 4 (very much disturbing). 4 subscales: impaired control of mental activities, becoming	4 factors (PCA, Sanavio, 1988; PCA, Kyrios et al, 1996; PCA, Sternberger and Burns 1990)	Internal consistency: α = 0.90-0.94 (total score) (Sanavio, 1988) Test-retest: r = 0.78-0.83 (Sanavio, 1988) Community sample	Obsessions and compulsions (Sanavio, 1988)

Questionnaire	Main citation	General Description	Factor structure	Validation	Type of compulsivity assessed (according to authors)
		contaminated, checking behaviours and urges and worries of losing control over motor behaviours.		(MacDonald and de Silva, 1999) Gambling disorder and problematic internet use (Chamberlain et al, 2017)	
Padua Inventory-Revised (PI-R)	van Oppen, Hoekstra &Emmelkamp, 1995	41 item scale with 5 subscales: impulses, washing, checking, rumination and precision. Answers are rated on a 5 point scale from 0 (not at all) to 4 (very much).	5 factors (Van Oppen et al, 1995; although not replicated by Gonner et al, 2010)	Internal consistency: α = 0.82-0.96 (subscales and total) (Gonner et al, 2010) Test-retest: Unable to find Anxiety and/or depression, OCD (Gonner et al, 2010)	Obsessive compulsive symptoms (van Oppen, 1995)
Padua Inventory Palatine Revision (PI-PR)	Gonner, Ecker & Leonhart, 2010	24 item revision of the PI, PI-R and the PI-WSUR. 6 subscales; contamination and washing, checking, numbers, dressing and grooming, rumination and harming obsessions and impulses. Answers are rated on a 5 point scale from 0 (not at all) to 4 (very much).	6 factors (CFA, Gonner, Ecker & Leonhart, 2010)	Internal consistency: α = 0.78-0.93 (subscales and total) (Gonner, Ecker & Leonhart, 2010) Test-retest: Unable to find Anxiety and/or depression, OCD (Gonner, Ecker & Leonhart, 2010)	Obsessive compulsive symptoms (Gonner, Ecker & Leonhart, 2010)
Padua Inventory-Washington State University Revision (PI-WSUR)	Burns, Keortge, Formea and Sternberger, 1996	39 item scale rated on a 5-point scale from Not At All (0) to Very Much (4). Organised into 5 subscales; obsessive thoughts about harm to self/others, obsessive impulses to harm self/others, contamination obsessions and washing obsessions, checking compulsions and dressing/grooming compulsions.	5 factors (PCA, Burns et al, 1996)	Internal consistency: α = 0.74-0.96 (subscales and total) (Gonner et al, 2010) Test retest: r = 0.76 (6-7 months; Burns et al, 1996) Community sample (Burns et al, 1996)	Obsessive Compulsive Disorder (Burns et al, 1996)
Vancouver Obsessional Compulsive Inventory-Revised (VOCI-R)	Gonner, Ecker, Leonhart and Limbacher, 2010	30-item scale with 5 subscales: contamination, checking, hoarding, symmetry/ordering and obsessions. Items are rated from 0 (Not at all) to 4 (Very much).	5 factors (CFA, Gonner, Ecker, Leonhart and Limbacher, 2010)	Internal consistency: α = 0.82-0.95 (subscales and total) (Gonner, Ecker, Leonhart and Limbacher, 2010) Test-retest: Unable to find OCD (Gonner, Ecker, Leonhart and Limbacher, 2010)	Obsessive compulsive symptoms (Gonner, Ecker, Leonhart and Limbacher, 2010)

α = Cronbach's α, r = Pearson's r. PCA = Principal Components Analysis; CFA = Confirmatory Factor Analysis; EFA = Exploratory Factor Analysis; PLS = Partial Least Squares.

Table 3

Validity and structure of impulsive and compulsive scales (in colour)

Scale	Internal consistency	Test-retest	Factor Structure	Convenience	No fee to access
Abbreviated Impulsiveness Scale (ABIS)	α = 0.71-0.88	Could not find data	3 factors (EFA, CFA, Coutlee et al, 2014)	13 item scale	Yes
Barkley Deficits in Executive Functioning, Self-Restraint/Inhibition Scale (BDEFS)	α = 0.93	r = 0.63-0.80 (2-3 weeks)	1 factor (PCA; Barkley and Murphy, 2011; ESEM, CFA, Kamradt et al, 2019)	19 items rated on 4 point Likert scale	No
Barratt Impulsiveness Scale 11 (BIS-11)	α = 0.79 (total score) = 0.58-0.78 (subscales)	r_s = 0.66-0.83 (1 month to 6 months)	6 first order components, 3 second-order impulsiveness factors (PCA; Patton et al, 1995) Alternative 3 factors (CFA, Ireland and Archer, 2008; CFA, Reid et al, 2014) 2 factors (CFA, Haden and Shiva, 2009; CFA, Reise et al, 2013)	30 items on a 4 point Likert scale	Yes
Barratt Impulsiveness Scale – 15 (BIS-15)	α = 0.81	r = 0.61-0.79 (6 months)	3 factors (PCA; Spinella, 2007)	15 items on a 4 point Likert scale	Yes
Barratt Impulsiveness Scale – Brief (BIS-Brief)	α = 0.73-0.83	r_s = 0.74 (1 day)	Single dimension of impulsivity (Bifactor; Steinberg et al, 2013) Single factor following modification (CFA, Fields et al, 2015) Two factors of impulsivity (EFA, CFA; Morean, DeMartini et al, 2014; CFA, Charles et al, 2019; PCA, CFA, Dunne et al, 2018)	8 items on a 4 point Likert scale	Yes
Behavioural Activation Scale (BAS)	α = .87	r = 59-69 (two months)	3 factors (EFA, Poythress et al, 2008; CFA, Ross et al, 2002) 3 factors but not adequate fit (CFA; Cogswell et al, 2006) Single factor (EFA, CFA; Maack and Ebesutani, 2018)	13 item scale, responses on a four-point Likert scale	Yes
Brief Assessment Tool of Compulsivity Associated Problems (BATCAP)	Unable to find	Unable to find	Unknown	6 questions per behaviour, responses on a 5 point scale	Yes
Brief Sensation Seeking Scale (BSSS)	α = 0.76	Unable to find	Unable to find	8 item scale with a 5 level Likert scale	Yes
Cambridge-Chicago Compulsivity Trait Scale (CHI-T)	α = 0.84	Unable to find	One factor (PLS, Albertella, Chamberlain et al, 2019) Two factors (EFA, Chamberlain and Grant, 2018)	15 item scale with 4 point Likert scale responses	Yes
Compulsive Activity Checklist (CAC)	α = 0.91	r = 0.68 (average of 36 days)	3 factors (PCA, Sternberger and Burns, 1990)	38 items rated on a 4-point scale	Yes
Dickman's Functional and Dysfunctional Impulsivity Inventory (DII)	α = 0.79 – 0.85	Unable to find	Seven factors, although two factors chosen (method not described; Dickman, 1990)	23 item scale with yes/no responses	Yes
Dimensional Obsessive-Compulsive Scale (DOCS)	α = 0.83-0.96	r = 0.55-0.66 (12 weeks)	4 factors (EFA, CFA, Abramowitz et al, 2010)	20 item scale with responses on a scale from 0 to 4	Yes

Scale	Internal consistency	Test-retest	Factor Structure	Convenience	No fee to access
Eysenck's Impulsiveness, Venturesomeness and Empathy (IVE-7)	α = 0.87 KR-20 = 0.624-0.819	Unable to find	3 factors (PCA, Eysenck et al, 1985; EFA, Caci et al, 2003)	54 item measure with yes/no answers	Yes
Impulsive Compulsive Behaviours Checklist (ICBC)	α = 0.84-0.89	Unable to find	2 factors (EFA, CFA, Guo et al, 2017)	33 behaviours listed with responses on a 4 point scale. Additional question asking if distress is caused.	Yes
Lifetime History of Impulsive Behaviors (LHIB-Q53)	α = 0.96	r = 0.88	Unable to find	53 item scale with frequency of behaviors rated on a 5 point scale	No
Multidimensional Personality Questionnaire Control Scale	α = 0.90	Unknown method = 0.82-0.92 (30 days)	Single factor included in the higher order constraint factor (Whiteside and Lynam, 2001)	24 item Control subscale	No
NEO-Personality Inventory-Revised (NEO-PI-R)	α = 0.63	Unable to find	Part of the neuroticism scale (Costa and McCrae, 1992)	Subscale of the NEO Personality Inventory Neuroticism scale	No
Obsessive-Compulsive Inventory-Revised (OCI-R)	α = 0.34-0.93	r_s = 0.57-0.87 (1-2 weeks)	6 factors (PCA, Foa et al, 2002)	18 item inventory with 6 subscales rating symptom trouble during past week. Items are rated on 5 point scale between Not at all (0) and Very much (4).	Yes
Padua Inventory (PI)	α = 0.90-0.94	Unknown method = 0.78-0.83	4 factors (PCA, Sanavio, 1988; PCA, Kyrios et al, 1996; PCA, Sternberger and Burns 1990)	60 item scale rated on a 5-point scale	Yes
Padua Inventory – Revised (PI-R)	α = 0.82-0.96	Unable to find	5 factors (Van Oppen et al, 1995; although not replicated by Gonner et al, 2010)	41 item scale with 5 subscales	Yes
Padua Inventory Palatine Revision (PI-PR)	α = 0.78-0.93	Unable to find	6 factors (CFA, Gonner, Ecker & Leonhart, 2010)	24 item scale with answers rated on a 5 point scale	Yes
Padua Inventory-Washington State University Revision (PI-WSUR)	α = 0.74-0.96	Unknown method = 0.76 (6-7 months)	5 factors (PCA, Burns et al, 1996)	39 item scale rated on a 5-point scale	Yes
Personality Research Form Impulsivity Scale	α = 0.81	Unable to find	Unidimensional subscale (EFA, Stricker, 1974)	A 16 item subscale of the Personality Research Form.	No
Positive Urgency Measure (PUM)	α = 0.95	r = 0.85 (Tested as part of UPPS-P,)	Unidimensional (EFA, CFA; Cyders et al, 2007)	14 item scale assessed on a four-point Likert scale	Yes
Recent Rash Impulsivity Scale (RRIS)	α = 0.53-0.68	r = 0.54-0.65 (4 weeks)	2 factors (EFA, CFA; Mayhew and Powell, 2014)	17 item scale	Yes
Risky, Impulsive and Self-Destructive Behavior Questionnaire (RISQ)	α = 0.92 (total score)	Unable to find	General factor and 8 specific factors (EFA, CFA, bifactor, Sadeh and Baskin-Sommers, 2016).	38 item scale based on frequency and age of onset of risky behaviours	Yes
Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ)	α = 0.75-0.83	r = 0.87-0.89 (3 months)	2 factors (PCA, Torrubia et al, 2001) Trimmed 2 factors although mixed support (EFA, CFA; O'Connor et al, 2004)	48 items with yes/no responses.	Yes
Sensation Seeking Scale (SSS-V)	α = 0.57-0.78	r = 0.87 (4 to 6 weeks)	4 factors (CFA; Loas et al, 2001; CFA, Roberti et al, 2003; CFA, Haynes et al, 2000)	40 item scale comprising 4 subscales and a total score.	Yes

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Scale	Internal consistency	Test-retest	Factor Structure	Convenience	No fee to access
Temperament and Character Inventory Impulsiveness (TCI)	α = 0.63	Unable to find	Unidimensional (PCA; Cloninger et al, 1991)	8 item subscale of the novelty-seeking dimension. True/false answers.	No
Temperament and Character Inventory – Revised – Impulsiveness (TCI-R)	α = 0.74	Unable to find	Unidimensional (EFA, CFA; Farmer and Goldberg, 2008)	9 item subscale from revised version of TCI. 5 point Likert scale	No
Trait Rash Impulsivity Scale (TRIS)	α = 0.73	*r* = 0.65 (4 weeks, total score)	2 factors (EFA, CFA; Mayhew and Powell)	17 item scale	Yes
UPPS-P Impulsive Behaviour Scale	α = 0.80-0.94	*r* = 0.81-0.93 (>1 day)	Five factors (CFA, Cyders and Smith, 2007)	59 item scale scored on a 4 point Likert scale	Yes
Short UPPS-P (S-UPPS-P)	α = 0.70-0.81	*r* = 0.60 (< 30 days)	Five factors (CFA; Dugre et al, 2019)	20 items rated on a 4 point Likert scale.	Yes
UPPS-R Impulsiveness Behaviour Scale	α = 0.82-0.91.	Unable to find	4 dimensions of impulsivity (EFA, CFA; Whiteside and Lynam, 2001)	45 item scale assessed on a 4 point Likert scale	Yes
Vancouver Obsessional Compulsive Inventory – Revised (VOCI-R)	α = 0.82-0.95	Unable to find	5 factors (CFA, Gonner, Ecker, Leonhart and Limbacher, 2010)	30-item scale. Items are rated from 0 to 4	Yes

Internal consistency measured using Cronbach's alpha unless otherwise stated. r = Pearson's r; r_S = spearman's rho. KR-20 = Kuder Richardson test. References can be found in Tables 1 and 2. Cronbach's alpha: ≥0.90, ≥0.70 deemed acceptable, 0.65-0.69 deemed minimally acceptable, <0.65 deemed unacceptable (DeVillis, 1991). Test-retest correlation coefficients: ≥0.70 deemed acceptable, 0.6-0.7 deemed questionable, <0.5 deemed poor (Hays et al, 1993). For scale length, <20 items deemed good, 20-30 items deemed mid-length and >30 items deemed long. For factor analysis, Green was deemed to be EFA followed by CFA, completed on separate populations with no other contradictory findings and supported by fit statistics. Amber was deemed to be factor analysis completed, either one of CFA, EFA, PLS or two types completed on the same population. Red was deemed to be factor analysis resulted in contradictory findings or no clear structure.