TESIS DOCTORAL

Study of Impulsivity Dimension in Borderline Personality Disorder:

The Influence of Impulsiveness, Impulsivity-Related Traits and Childhood Sexual Abuse to Suicidal Behaviour

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Liliana Ramos Ferraz

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Study of Impulsivity Dimension in Borderline Personality Disorder: The Influence of Impulsiveness, Impulsivity-Related Traits and Childhood Sexual Abuse to Suicidal Behaviour

Tesis Doctoral presentada por:

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Doctorat en Psicopatologia d'Infants, Adolescents i Adults

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Declara y certifica que ha supervisado la tesis doctoral titulada:

'Study of impulsivity dimension in Borderline Personality Disorder: The influence of impulsiveness, impulsivity-related traits and childhood sexual abuse to suicidal behaviour'

Por tal motivo queda constancia en el presente documento en Barcelona, 4 de Julio de 2014.

Dra. Susana Subirà Álvarez

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PREFACE

The present thesis represents the research work developed as a psychologist in the Psychiatric Unit of the Hospital Duran i Reynals of Barcelona, in collaboration with the Grup de Recerca en Vulnerabilitat, Psicopatologia i Gènere (2014 SGR 1411; Fundació Clínic per a la Recerca Biomèdica, Hospital Clínic), Departament de Psicologia Clínica i de la Salud, of Universitat Autònoma de Barcelona. This manuscript is presented as a compendium of publications that consists of two peer-reviewed articles published in the course of the research work developed, detailed below:

STUDY 1: Ferraz, L., Vállez, M., Navarro, J.B., Gelabert, E., Martin-Santos, R., Subira S. (2009). Dimensional assessment of personality and impulsiveness in borderline personality disorder. Personality and Individual Differences, 46(2), 140-146.

STUDY 2: Ferraz, L., Portella, M. J., Vállez, M., Gutiérrez, F., Martín-Blanco, A., Martin-Santos, R., & Subirà, S. (2013). Hostility and childhood sexual abuse as predictors of suicidal behaviour in borderline personality disorder. Psychiatry research, 210(3), 980–985.

The structure of this manuscript begins with a brief Justification of the study (1) presenting the general rational of this doctoral dissertation, followed by Introduction (2), where a theoretical review of the current state of the art is presented. The description of the study's Aims and Hypotheses (3) are followed by Publications (4), a section that consists of a copy of the two empirical studies published with a detail description of the developed work. Finally, Discussion (5) of the main findings and their implication to the clinical and research field is presented, and the Conclusions (6) section with the main concluding observations.

ABSTRACT

The present work is a doctoral dissertation concerning two cross-sectional studies examining a series of severity-related variables in Borderline Personality Disorder (BPD). In the first study, the aim was to address the multidimensional nature of impulsivity in BPD subjects, using different self-report measures of impulsivity and impulsivity-related traits together with a laboratorial behavioural measure. In the second work, we intended to clarify the role of these personality traits as well as the impact of sexual abuse during childhood in relation to suicidal behaviour in BPD patients.

In the first study, we compared the differences in self-report instruments and the performance in a laboratorial measure of impulsivity between a sample of 39 BPD female subjects and 102 healthy controls. As self-reported measures of impulsivity and impulsivity-related traits, the Barratt Impulsiveness Scale-11 (BIS-11), the Buss-Durkee Hostility Inventory (BDHI) and the Temperament and Character Inventory (TCI-R) were used. We used a Continuous Performance Test (CPT) as a laboratorial-behavioural measure of response inhibition and behavioural impulsivity. The results in the psychometric instruments revealed that BPD subjects were characterized by higher levels of trait impulsiveness and hostility in several of its domains, and by higher temperament traits of novelty seeking and harm avoidance compared to healthy controls. Concerning the laboratorial-behavioural measure of impulsivity, there were no differences in the performance between BPD and control subjects.

In the second study, we examined the relationships between impulsivity and impulsivity-related traits, as well as the presence of childhood sexual abuse in relation to suicidal behaviours in a sample of 76 BPD patients. We first analysed the differences between BPD patients with and without previous suicide attempts concerning personality measurements, childhood sexual abuse and overall disorder severity. In a second set of analyses, we performed different regression analyses to determine the independent contribution of these variables to suicidal behaviours. Suicidal related variables were assessed by means of a structured interview designed to obtain a detailed history of previous suicidal behaviour and childhood sexual abuse was registered using a clinical interview designed for the purpose of the present work. Finally, the Global Assessment of Functioning (GAF) was used to evaluate general symptoms and disorder severity. The results showed that BPD individuals with history of suicidal behaviours were characterized by higher levels of behavioural and attitudinal hostility, also in three of its facets, resentment, suspiciousness and guilt, in comparison to non-attempters BPD patients. In contrast, no differences were found in any other personality variables. In relation to childhood sexual abuse, BPD individuals with previous suicide attempts report significantly higher percentages of sexual abuse during childhood than BPD patients without attempts. Consistently, results from regression analyses indicated that increased hostility and having suffered sexual abuse during childhood predicted the presence, higher number and severity of suicide attempts, suggesting both factors as relevant risk factors for suicidal behaviours in BPD.

Taken together, the main results of the present work support impulsivity dimension as a prominent feature in BPD, and suggest that within the construct impulsivity, hostility (more related to impulsive aggression) could be a potential biological risk factor, and childhood sexual abuse as an environmental risk factor for suicidal behaviour in BPD.

RESUMEN

Este trabajo de tesis doctoral incluye dos estudios transversales que examinan una serie de variables relacionadas con la gravedad del Trastorno Límite de la Personalidad (TLP). El objetivo del primer estudio consistió en estudiar la naturaleza multidimensional de la impulsividad en pacientes con TLP, mediante el uso de diferentes medidas psicométricas de la impulsividad y rasgos relacionados, conjuntamente con una medida de laboratorio de la conducta impulsiva. El segundo estudio tuvo como principal objetivo aclarar la implicación de estos rasgos de la personalidad y los antecedentes de abuso sexual en la infancia en la conducta suicida en pacientes con TLP.

En el primer estudio, 39 mujeres diagnosticadas de TLP fueron comparadas con 102 controles sanos en cuanto a las puntuaciones obtenidas en diferentes instrumentos psicométricos y al rendimiento en una medida de laboratorio de impulsividad. Como medidas psicométricas de impulsividad y rasgos relacionados se emplearon la Escala de Impulsividad de Barratt-11 (BIS-11), el Inventario de Hostilidad de Buss-Durkee (BDHI) y el Inventario del Temperamento y el Carácter (TCI-R). El *Continuous Performance Test* (CPT-IP) fue utilizado como medida de laboratorio de la capacidad de inhibición de respuesta, constituyendo un marcador de la respuesta impulsiva. Los resultados en los instrumentos psicométricos revelaron que los sujetos con TLP se caracterizan por una elevada impulsividad-rasgo y elevada hostilidad en varias de sus facetas, y por puntuaciones extremas en los rasgos de temperamento de búsqueda de novedad y de evitación del daño en comparación con los controles sanos. No se obtuvieron diferencias significativas entre pacientes TLP y sujetos controles en el rendimiento del CPT-IP.

En el segundo estudio, se analizó la relación entre la impulsividad y rasgos relacionados, los antecedentes de abuso sexual en la infancia y los comportamientos suicidas en una muestra de 76 pacientes diagnosticados con TLP. Primeramente, se analizaron las diferencias entre pacientes con TLP con y sin antecedentes de suicidio en relación a las medidas de personalidad, el abuso sexual en la infancia y la gravedad general del trastorno, a lo que se siguieron un conjunto de análisis de regresión con el objetivo de determinar la contribución independiente de estas variables para las conductas suicidas. Las variables relacionadas con el suicidio y con el abuso sexual en la infancia fueron recogidas mediante una entrevista estructurada diseñada *ad hoc*. Por último, se utilizó la Escala de Evaluación de la Actividad Global (EEAG) para evaluar la gravedad general y sintomatológica del trastorno. Los individuos con TLP con antecedentes de conductas suicidas obtuvieron puntuaciones más elevadas en hostilidad y en tres de sus facetas - resentimiento, desconfianza y culpa-, al compararlos con los pacientes con TLP sin intentos previos. No se encontraron diferencias significativas para otras variables de la personalidad entre los dos grupos. En relación al abuso sexual en la infancia, los sujetos con TLP con antecedentes de suicidio revelaron prevalencias significativamente más elevadas de abuso sexual en la infancia que los pacientes TLP sin intentos previos. Consistentemente, los resultados de los análisis de regresión indicaron que una elevada hostilidad y el hecho de haber sufrido abusos sexuales en la infancia son variables predictoras de la presencia, mayor número y mayor gravedad de los intentos de suicidio, lo que apunta a estas dos variables como importantes factores de riesgo para las conductas suicidas en el TLP.

Así pues, los resultados de este trabajo sustentan el papel preponderante de la dimensión impulsividad en el TLP. Asimismo, sugieren que la hostilidad, entendida como agresividad impulsiva, podría actuar como un potencial factor de riesgo biológico, mientras que el abuso sexual en la infancia representaría un factor de riesgo ambiental para la conducta suicida en el TLP.

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1. JUSTIFICATION OF THE STUDY

1 JUSTIFICATION OF THE STUDY

Borderline Personality Disorder (BPD) is a severe and complex mental disorder with high prevalence in psychiatric settings and a high mortality rate due to suicide. The pathogenesis of BPD is still unknown and appears to involve complex interactions between genetic, neurobiological and environmental factors, resulting in a pattern of general instability in core features such as emotional dysregulation and poor impulse control (Amad, Ramoz, Thomas, Jardri, & Gorwood, 2014; Stone, 2014). Although impulsivity is considered a nuclear feature of the disorder (Lieb, Zanarini, Schmahl, Linehan, & Bohus, 2004; Links, Heslegrave, & van Reekum, 1999; Paris, 2007), discrepancies in previous research indicate that the role of impulsivity in BPD is not yet fully understood. Personality traits, such as impulsivity and other related traits, and adverse experiences during childhood have been related to an increase risk of suicidality in BPD (Kolla, Eisenberg, & Links, 2008; Links, Kolla, Guimond, & McMain, 2013; Sanislow et al., 2009; Soloff & Chiappetta, 2012; Wedig et al., 2012). Nevertheless, it is unclear how biological and potential inherited risk factors, such as personality traits, may interact with early adverse experiences, such as childhood sexual abuse, to eventually lead to suicidal behaviours in BPD.

Impulsivity, understood as a stable trait of personality, has been characterized as a multidimensional construct (Bornovalova, Lejuez, Daughters, Zachary Rosenthal, & Lynch, 2005; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001; Peters, Upton, & Baer, 2013). In BPD it is considered to be an underlying dimension of the disorder, generally expressed by severe behavioural disturbance with increased aggressive and impulsive behaviour. Aggressiveness and impulsive-aggression are also predominant features of BPD and highly related to impulsivity construct (Bornovalova et al., 2005; Ramírez & Andreu, 2006; Skodol et al., 2002). Although these psychological traits have been conceptualized together they are in fact different phenomena (Critchfield, Levy, & Clarkin, 2004; García-Forero, Gallardo-Pujol, Maydeu-Olivares, & Andrés-Pueyo, 2009) and previous clinical and

experimental studies investigating impulsivity and impulsive aggression in BPD have provided mixed results (Gvion & Apter, 2011; Soloff, White, & Diwadkar, 2014). Moreover, when measured by means of standard self-report instruments, BPD patients generally show high levels of impulsivity and aggressiveness/hostility (Berlin, Rolls, & Iversen, 2005; Domes et al., 2006; Keilp et al., 2006; Soloff, Lynch, Kelly, Malone, & Mann, 2000). In contrast, on the level of behavioural or experimental tests results are contradictory and BPD patients seem to be less impaired than initially expected. While previous research has reported an impaired response inhibition in patients with BPD (Dell'Osso, Berlin, Serati, & Altamura, 2010; Feliu-Soler, Soler, et al., 2013; Krause-Utz et al., 2013), others have failed to found evidence of impairment in this neuropsychological domain (Jacob et al., 2010; Lampe et al., 2007; McCloskey et al., 2009; Sebastian, Jacob, Lieb, & Tüscher, 2013). Furthermore, only few studies have used self-report instruments combined with laboratorial-based measures of impulsivity in BPD patients. To address this matter, one of the aims of the present work was to assess impulsivity and impulsivity related traits using self-report scales in BPD patients comparing to a healthy control group, and a laboratorial behavioural measure to assess the ability of BPD patients in response inhibition and compare different data level (Study 1).

Impulsivity and other impulsivity-related traits such as hostility/aggressiveness, as well as more broad temperament traits as novelty seeking and harm avoidance, have been implicated as risk factors for suicidal behaviour (Conrad et al., 2009; Gvion & Apter, 2011; Gvion et al., 2014; Keilp et al., 2006; Links et al., 2013; Paris, 2005b; Stringer et al., 2013). Recurrent suicidal behaviour is present in about 70% of BPD patients, and is one of the most important indicators of severity of the disorder (Herpertz et al., 2007; Wedig et al., 2012; Zanarini et al., 2008). Although most patients achieve remission of suicidal behaviour over time, as many as 10% die by suicide. It is not clear how different components of impulsivity and its related traits contribute to the development of suicidal behaviours as this relationship may be confounded by the heterogeneous and complex nature of the construct. In addition, apart from personality and temperament traits, the influence of

certain environmental factors such as early traumatic experiences, childhood sexual abuse in particular, have been suggested as a potential risk factor for suicide in BPD (Bedi et al., 2011; Brodsky et al., 2008; Soloff, Lynch, & Kelly, 2002; Yen et al., 2009). Childhood sexual abuse is highly frequent among BPD subjects, with rates between 40 and 71%, and it has been suggested that occurrence and severity of childhood sexual abuse may predict suicidal behaviour independent of other known risk factors (Soloff, Feske, & Fabio, 2008; Soloff et al., 2002; Zweig-Frank et al., 2006). Being so, the second main purpose of the present work was to study the relationship between suicidal behaviour and having suffered sexual abuse during childhood. Additionally, we aimed to clarify and understand the role of impulsivity and its related traits in relation to suicidal behaviours, in order to determine the joint effect of both psychological (personality traits) and environmental risk factors (childhood sexual abuse) on suicidal behaviours in BPD (Study 2).

The results of the present thesis may contribute to a better clinical characterization of BPD, particularly of the severe behavioural dysfunction associated to impulsivity and impulsive aggression, highlighting the importance of its correct identification and assessment. On the other hand, this data investigate several factors related to BPD severity, which may provide additional knowledge relating potential risk factors of suicidality in BPD. The identification of those factors that increase the risk of occurrence and development of these behaviours can provide relevant information to ameliorate BPD severity and help in the development of more effective guidelines for its intervention.

2. INTRODUCTION

2 INTRODUCTION

2.1 BORDERLINE PERSONALITY DISORDER: GENERAL INTRODUCTION

2.1.1 Evolution of the concept

Borderline Personality Disorder (BPD) is a complex and severe psychiatric disorder that has gained increasing interest for the past decade. BPD is associated with high mortality due to suicide, frequent hospitalization, substance use, and poor quality of interpersonal relationships. The heterogeneity of its clinical presentation, the difficulties in the conceptualization and the lack of a unifying personality theory have lead to a great amount of terms and a disagreement among authors about the essential attributes that characterize the disorder.

Despite the controversy surrounding the term 'borderline', BPD arises from the need to classify a group of patients with a clear pattern of affective and interpersonal instability, marked impulsivity and inappropriate anger that do not fit within the traditional syndromes (NICE, 2009). The term 'borderline personality' was first introduced by Adolph Stern in 1938 to describe a group of patients refractory to psychoanalysis treatment and who did not seem to belong neither into the psychotic nor into the neurotic group (Stern, 1938). Latter, Otto Kernberg proposed the term 'borderline personality organization' to refer to a consistent pattern of functioning and behaviour characterized by instability, reflecting a disturbed psychological self-organization (Kernberg, 1967). The cluster of symptoms and behavioural pattern associated with borderline personality became increasingly and widely recognised. It included marked fluctuations between periods of confidence and times of absolute despair, unstable self-image, rapid changes of mood, fears of abandonment and rejection, and a strong tendency towards suicidal thinking and self-harm, and could also include transient psychotic symptoms (NICE, 2009). The clinical characteristics that currently define BPD were

previously described by Gunderson and Kolb (1978), and are in line with the contemporary psychiatric classifications.

BPD is only introduced in the Diagnostic and Statistical Manual of Mental Disorders in its third revision in 1980 (DSM-III, American Psychiatric Association, 1980), and despite the numerous critiques and alternative proposals this term has remained unchanged in its subsequent versions, including the recently published fifth edition, DSM-5 (APA, 2013). Since then, the disorder has captured the attention of researchers and clinicians and has become the most studied personality disorder.

2.1.2 Clinical characterization and diagnostic criteria

BPD is a complex clinical syndrome characterized by a general pattern of instability in emotions regulation, interpersonal relationships, self-image and impulse control (Herpertz et al., 2007; Leichsenring, Leibing, Kruse, New, & Leweke, 2011; Lieb et al., 2004; Paris, 2005a). There is no agreement in which is the main feature of the disorder, while for some it would be impulsivity, for others it would be emotional dysregulation or even the serious difficulties in interpersonal relationships. According to the ICD-10 (WHO, 1993), BPD refers to a main diagnostic category labelled as Emotionally Unstable Personality Disorder, and is divided into two subcategories of impulsive and borderline personality type (Table 1). This classification describes BPD as a disorder with a marked tendency to act impulsively without consideration of the consequences, together with affective instability. Additionally, both subtypes share a general impulsiveness and lack of self-control. In the impulsive type the predominant characteristics are emotional instability and lack of impulse control, and the presence of outbursts of violence or threatening behaviours, particularly in response to criticism by others are also common. In the borderline type, several characteristics like emotional instability, individual's self-image, aims, and internal preferences (including sexual) are often unclear or disturbed. There are usually chronic feelings of emptiness, and a liability to become

involved in intense and unstable relationships. This instability may cause repeated emotional crises and may be associated with excessive efforts to avoid abandonment and a series of suicidal threats or acts of self-harm (WHO, 1993).

However, the Diagnostic and Statistical Manual of Mental Disorders (DSM) is currently the more widely used system to describe and diagnose BPD. According to DSM-IV-TR (APA, 2000), five of the nine diagnostic criteria are needed to establish a BPD diagnose, in addition to the general criteria of personality disorder (Table 1). Affective disturbance is one of BPD nuclear features characterized by the intensity and variability of mood states. Patients exhibit intense mood reactivity in the personal realm, with frequent and rapidly changing affective states within one day. These mood changes are generally unpredicted and usually caused by a heightened reactivity to external events (APA, 2006). This dysphoric affect typically ranges from anxiety to sadness, and can be experienced as aversive tension, feelings of rage, fear, sorrow, shame and guilt. Individuals with this disorder also typically experience inappropriate intense anger or have difficulty controlling it, which can be triggered by perception of neglectful, uncaring or abandoning (Gunderson, 2011). It is also a very common characteristic of BPD patients the chronic feelings of emptiness and loneliness. Impulsivity is a predominant feature in BPD, and generally self-damaging in its effects, expressed by behaviours such as disordered eating, substance abuse, reckless driving, unprotected sexual conducts, money spending, etc. Unstable, intense relationships are another feature, characterized by a profound fear of abandonment and by unpredictable changes between extremes of idealization or devaluation (Gunderson, 2011). Manifestations of disturbed cognition may also occur during periods of extreme stress, and are mostly no-psychotic symptoms like dissociative experiences of depersonalization, derealization and pseudohallucinations (APA, 2006). BPD individuals can manifest identity disturbance that consists of markedly and persistent unstable self-image or sense of self expressed by suddenly changes in goals, values, type of friends, etc. Finally, self-mutilation and suicidal behaviours, threats or gestures can also be present, and are often

precipitated by potential separation from others, or feelings of rejection or abandonment (Gunderson, 2011).

Table 1. BPD classification and criteria according to DSM-IV-TR (Borderline Personality Disorder) and ICD-10 (Borderline Type personality disorder

DSM-IV-TR	**ICD-10** (Research criteria)
301.83 Borderline Personality Disorder A pervasive pattern of instability of interpersonal relationships, self-image, and affects, and marked impulsivity beginning by early adulthood and present in a variety of contexts, as indicated by five (or more) of the following: **1.** Frantic efforts to avoid real or imagined abandonment* **2.** A pattern of unstable and intense interpersonal relationships characterized by alternating between extremes of idealization and devaluation. **3.** Identity disturbance: markedly and persistently unstable self-image or sense of self. **4.** Impulsivity in at least two areas that are potentially self-damaging (e.g., spending, sex, substance abuse, reckless driving, binge eating).* **5.** Recurrent suicidal behaviour, gestures, or threats, or self-mutilating behaviour. **6.** Affective instability due to a marked reactivity of mood (e.g., intense episodic dysphoria, irritability, or anxiety usually lasting a few hours and only rarely more than a few days). **7.** Chronic feelings of emptiness. **8.** Inappropriate, intense anger or difficulty controlling anger (e.g., frequent displays of temper, constant anger, recurrent physical fights). **9.** Transient, stress-related paranoid ideation or severe dissociative symptoms. *Note: does not include suicidal or self-mutilation behaviour covered in criterion 5.	**F60.3 Emotionally Unstable Personality Disorder** **F60.30 Impulsive type** **A.** The general criteria for personality disorder (F60) must be met. **B.** At least three of the following must be present, one of which must be (2): **1.** Marked tendency to act unexpectedly and without consideration of the consequences; **2.** Marked tendency to quarrelsome behaviour and to conflicts with others, especially when impulsive acts are thwarted or criticized; **3.** Liability to outbursts of anger or violence, with an inability to control the resulting behavioural explosions; **4.** Difficulty in maintaining any course of action that offers no immediate reward; **5.** Unstable and capricious mood. **F60.31 Borderline type** **A.** The general criteria for personality disorder (F60) must be met. **B.** At least three of the symptoms mentioned in criterion B for F60.30 must be present, with at least two of the following in addition: **6.** Disturbances in and uncertainty about self-image, aims and internal preferences (including sexual); **7.** Liability to become in involved in intense and unstable relationships, leading to emotional crises; **8.** Excessive efforts to avoid abandonment; **9.** Recurrent threats or acts of self-harm; **10.** Chronic feelings of emptiness.

In DSM-IV-TR, BPD and personality disorders were categorized in Axis II. Recently, it has been published the fifth version, the DSM-5 (APA, 2013), and one of the clearest changes is that it moves from a multiaxial system to a new approach that removes the arbitrary boundaries between

personality disorders and other mental disorders. Along with its development, several important changes to the categorization and definition of personality disorders were suggested, in an attempt to break down the concise models of personality disorders which can be too rigid to fit patients' symptoms (Gunderson, 2013; Widiger, 2011). A different approach would diagnose personality disorders using a trait-specific method, in which clinicians would determine the presence of personality disorders by assessing their symptoms and ranking each trait by severity (Miller, Morse, Nolf, Stepp, & Pilkonis, 2012). However, the announced restructuration of personality disorders, i.e. changing from a categorical to a dimensional classification has finally been rejected for a lack of agreement. These proposed revisions were not accepted for the main body of the manual, yet an alternative hybrid dimensional-categorical model was included in a separate chapter of DSM-5 (Section III) (APA, 2013). This alternative model is included to encourage further study on how this new methodology could be used to assess personality and diagnose personality disorders in clinical practice (Anderson, Snider, Sellbom, Krueger, & Hopwood, 2014; Sellbom, Sansone, Songer, & Anderson, 2014). However, in this last version it was finally decided to maintain a categorical approach to personality disorders diagnose, and only minor changes were included to BPD criteria which remained essentially the same.

2.1.3 Categorical versus dimensional models

The discussion whether a categorical or a dimensional model best describes and characterize personality disorders is an ongoing debate (Barnow et al., 2006; Gunderson, 2013; Miller et al., 2012; Trull & Durrett, 2005). Although the majority of the literature concerning personality disorders uses a categorical approach to describe personality pathology, empirical evidence consistently suggests that dimensional models provide a more adequate representation of personality disorders rather than the categorical ones (Barnow et al., 2006; Dell'Osso et al., 2010; Gore & Widiger, 2013; Hengartner, Ajdacic-Gross, Rodgers, Müller, & Rössler, 2014; Steinmeyer

et al., 2002; Svrakic, Whitehead, Przybeck, & Cloninger, 1993; Trull & Widiger, 2013; Vall et al., 2012; Watson, Stasik, Ro, & Clark, 2013; Widiger, 2011).The most frequently pointed limitations to the categorical conceptualization of personality pathology are: excessive comorbidity, use of arbitrary cutoffs to distinguish normal from pathological functioning and failure to capture variations in the adaptive value of personality disorder symptoms (Arntz et al., 2009; Bornstein, 2011).

Several authors support the conceptualization of personality disorders as extreme positions of underlying dimensional constructs, proposing continuous transitions from normal to disordered personalities and universal validity of basic personality dimensions (Barnow et al., 2006; Bornstein, 2011; Gutiérrez et al., 2008; Steinmeyer et al., 2002; Trull & Widiger, 2013; Widiger & Mullins-Sweatt, 2009; Widiger, 2011). There are several well-established dimensional models developed to describe broad domains of personality such as the five-factor model of personality (Widiger & Trull, 2007), the four-factor model of Livesley (Livesley, 2007), the three-factor model developed by Clark and Watson (Clark & Watson, 2008) or Cloninger's seven-dimensional model (Cloninger, Svrakic, & Przybeck, 1993).

The psychobiological model of temperament and character developed by Cloninger (Cloninger, 1987) is one of the most contributing models in the understanding of personality psychopathology. Cloninger bases his model of personality structure and development on the physiological underpinnings of behaviour and an underlying biogenic structure of personality (Cloninger et al., 1993). He has identified four temperament scales and three character dimensions, developed through research on studies of twins and families, longitudinal development, and neuropharmacology. Cloninger defines temperament factors as dimensions of personality that 'involve automatic, preconceptual responses to perceptual stimuli, presumably reflecting heritable biases in information processing' (Cloninger et al., 1993, p.977). The four temperament dimensions

are novelty seeking (activation or initiation of behaviour), harm avoidance (inhibition or cessation of behaviour), reward dependence (maintenance of ongoing behaviour) and persistence (perseverance of behaviour despite frustration and fatigue); and three character dimensions: self-directedness, cooperativeness and self-transcendence. According to this model, while personality disorder subtypes could be differentiated by different combinations of temperament dimensions, low character dimensions would be a common ground of all personality disorders. In relation to BPD, Cloninger suggested that these individuals would be characterized by a combination of high novelty seeking, low harm avoidance and high reward dependence (Cloninger et al., 1993). Subsequent findings have led to a revision of this prediction also supported by more recent publications suggesting that BPD is associated with high novelty seeking, high harm avoidance (Barnow et al., 2006; Bricaud, Calvet, Viéban, Prado-Jean, & Clément, 2012; Cloninger, 2000; Fassino et al., 2009; Joyce et al., 2003; Kaess et al., 2013; Pukrop, 2002; Soloff et al., 2014; Steinmeyer et al., 2002; Svrakic et al., 1993; van Dijk, Lappenschaar, Kan, Verkes, & Buitelaar, 2012), and some studies also reported moderate reward dependence (Kaess et al., 2013; Korner, Gerull, Stevenson, & Meares, 2007). According to Cloninger's postulations (1993), while temperament dimensions are supposed to be independently heritable and manifest early in life, character dimensions would mature latter and influence personal and social effectiveness. Individual differences in the expression of temperament dimensions are proposed to reflect genetically influenced sensitivity on a range of neurological systems, including the dopamine reward pathways, serotonergic and noradrenergic systems. Indeed, there is some evidence for associations between serotonergic and dopaminergic genes and certain dimensions of temperament traits such as novelty seeking and harm avoidance (Calati et al., 2008; Gerra et al., 2005; Serretti et al., 2006). More recently, findings from neuroimaging studies suggested that individual variations in brain morphology could be related to Cloninger's temperament and character dimensions (Van Schuerbeek, Baeken, De Raedt, De Mey, & Luypaert, 2011). Taken together, these findings provide

some scientific evidence for the use of this dimensional model as an alternative conceptualization to personality disorder, and particularly, to BPD.

2.1.4 Epidemiology

Epidemiological studies of personality disorders in general population are scarce. Community surveys in adults indicate that the prevalence of BPD is between 1- 2 % in general population (Grant et al., 2008; Samuels et al., 2002; Torgersen, Kringlen, & Cramer, 2001). In clinical populations, BPD is the most common personality disorder, with a estimated prevalence between 11% to 20% in psychiatric outpatients and between 18% to 32% of inpatients (APA, 2000). Regarding gender distribution, the disorder is predominantly diagnosed in females (about 75% of cases). Although this female predominance appears in most studies, this sex differences are less striking in community samples (Lenzenweger, Lane, Loranger, & Kessler, 2007; Torgersen et al., 2001).

2.1.5 Comorbidity and differential diagnosis

BPD individuals generally show high comorbidity with axis I and axis II disorders (Grant et al., 2008; Ha, Balderas, Zanarini, Oldham, & Sharp, 2014; Leichsenring et al., 2011; Lenzenweger et al., 2007; Links et al., 2013; McGlashan et al., 2000; Sanislow et al., 2009; Skodol, Gunderson, Pfohl, et al., 2002), which can complicate and worsen the course of the disorder (APA, 2006). Nearly 85% of BPD patients met criteria for one or more axis I disorders, and 74% met criteria for another lifetime axis II disorder (Grant et al., 2008; Lenzenweger et al., 2007). Among axis I comorbidity, the highest prevalence rates are found for major depression disorder, dystimia, bipolar disorder, anxiety disorders, substance abuse disorders, and eating disorders (Carpiniello, Lai, Pirarba, Sardu, & Pinna, 2011; Gremaud-Heitz et al., 2014; Links & Eynan, 2013; Skodol et al., 2005; Tadić et al., 2009; Zimmerman et al., 2013). Differential diagnosis of BPD can be

complicated by the presence of these co-occurring disorders, as BPD symptoms can overlap some of its features. For instance, affective instability and impulsivity in BPD may mimic bipolar disorder symptoms, especially bipolar II disorder, and approximately 20% of patients diagnosed with BPD have a comorbid bipolar disorder (Paris, 2007; Zimmerman et al., 2013). However, in BPD the mood swings are often triggered by interpersonal stressors, and a particular mood is usually less sustained that in bipolar disorder. Differential diagnosis with depressive symptoms should also be taken into account because they characterize both BPD and major depressive disorder. Nonetheless, typical BPD depressive features such as emptiness, abandonment fears, self-destructiveness, and hopelessness are more enduring aspects (APA, 2006). Furthermore, it can be particularly difficult to differentiate dystimic disorder from BPD. Even so, the presence of the previously mentioned mood swings triggered by interpersonal stressors should favour consideration of BPD diagnosis. Post-traumatic stress disorder is also frequently associated to patients with BPD (Grant et al., 2008; Tsai et al., 2014). However, a history of trauma is frequently reported in patients with BPD and does not necessarily warrant additional diagnosis of post-traumatic stress disorder. While this disorder is characterized by rapid-onset symptoms that occur usually in adulthood, in reaction to exposure to a recognizable and extreme stressor (APA, 2006), BPD is characterized by early-onset and enduring personality traits. In terms of gender differences, it has been suggested that disorders associated with substance abuse being more common in men, and eating disorders being more common in women (Grant et al., 2008; Leichsenring et al., 2011). More recent studies have also reported relatively high rates of comorbidity with attention deficit hyperactivity disorder (ADHD), with estimated rates of about 20% (Asherson et al., 2014; Ferrer et al., 2010; Lim et al., 2012; Vidal et al., 2014).

Regarding axis II, BPD most frequently diagnosed comorbid personality disorders are antisocial, avoidant, histrionic, narcissistic and schizotypal personality disorders (Grupo de trabajo de la guía de práctica clínica sobre trastorno límite de la personalidad, 2011; Herpertz et al., 2007; Sanislow et

al., 2009). Borderline pathology may be confused with other personality disorders especially in those with similar features. For example, cognitive dysregulation symptoms may be confused with schizotypal or paranoid disorder, but in BPD paranoid ideas and high sensitivity are usually temporary symptoms and generally reactive to external stressful events. For dependent personality disorder features such as fear of abandonment may confound the differential diagnosis, but in BPD usually there are also reactions of anger, emptiness or unstable personal relationships. Behavioural dysregulation and substance abuse behaviours can confound with antisocial personality disorder but in this latter, manipulative behaviours tend to be related with achieving a profit, gratification or power. The pattern of experiential avoidance responses in presence of negative emotions can also be observed in patients with avoidant personality disorder, but while in these patients the predominant emotion is fear, in BPD case the repertoire of emotions is much wider.

2.1.6 Etiology

The etiology and pathogenesis of BPD is still unknown and seems to involve complex interactions among genetic, neurobiological and environmental factors (Amad et al., 2014; Dell'Osso et al., 2010). Considering the heterogeneity of the disorder, it is possible that a combination of several of these factors is involved in BPD manifestation. The main theories postulate that early adverse events (e.g. childhood abuse or maternal separation), genetics, neurobiological alterations, or a combination of both, could be responsible for the onset of BPD, along with external factors such as environmental and psychossocial stressors (Calati, Gressier, Balestri, & Serretti, 2013; De Fruyt & De Clercq, 2014; Joyce, Stephenson, Kennedy, Mulder, & McHugh, 2014; O'Neill & Frodl, 2012; Stone, 2014; Vermetten & Spiegel, 2014).

The biological aspects in personality disorders are related to temperamental trait dispositions reflected by stable patterns of thoughts, affect and behaviour that characterize individual differences (Steinmeyer et al., 2002). In BPD, there is an increasing evidence for its development in childhood

and further manifestation in adolescence or early adulthood (Paris, 2005a, 2005b). To some authors it is regarded as a life span developmental disorder (Chanen & Kaess, 2012; Tackett, Balsis, Oltmanns, & Krueger, 2009), and findings from neurobiological studies suggest that some BPD symptoms are hereditable and could be identified as early as in childhood (Distel et al., 2011; Skodol, Siever, et al., 2002; Torgersen, 2000). Results from genetic studies suggest that BPD has a heritability of about 0.69 (Reichborn-Kjennerud et al., 2013; Torgersen, 2000). There is also some evidence that the degree in which BPD is caused by inborn factors seems to be explained by heritability of traits related to impulsivity and affective instability, rather than the disorder itself (Calati et al., 2013; De Fruyt & De Clercq, 2014; NICE, 2009; Paris, 2005a). The existence of a genetic vulnerability to BPD seems largely supported, yet no susceptibility gene has been clearly implicated in its etiology (Amad et al., 2014). Studies of neurotransmitter activity have shown that impulsive and aggression traits are associated with deficits in central serotonergic functioning (Calati et al., 2013; Winstanley, 2011) and are moderately heritable (Bevilacqua & Goldman, 2013; Bevilacqua et al., 2010; Bezdjian, Baker, & Tuvblad, 2011). There is also evidence for an altered function in neurotransmitter systems including serotonin, glutamate, and GABA systems observed in BPD individuals (Dell'Osso et al., 2010; Joyce et al., 2014; Krause-Utz, Winter, Niedtfeld, & Schmahl, 2014; Stone, 2014). On a neuronal level, structural and functional neuroimaging studies in BPD have found evidence for structural and functional abnormalities in brain areas central to affect regulation, attention and self-control, and executive functions, supporting the assumption for a frontolimbic network dysfunction in BPD (Dell'Osso et al., 2010; Krause-Utz et al., 2014; Leichsenring et al., 2011; O'Neill & Frodl, 2012). Specifically, it has been reported dysfunction in the anterior cingulated cortex, the orbital frontal and dorsolateral prefrontal cortex, the hippocampus, and the amygdala (Herpertz et al., 2007; Lieb et al., 2004; Stone, 2014). Limbic hyperreactivity and diminished recruitment of frontal regions may yield to a link between disturbed

emotion processing and other core features of BPD such as impulsivity and interpersonal disturbances (Krause-Utz et al., 2014).

Furthermore, biological influence in personality disorder seems to be mediated by the interaction with environmental factors (Braquehais, Oquendo, Baca-García, & Sher, 2010; Gratz, Latzman, Tull, Reynolds, & Lejuez, 2011; Leichsenring et al., 2011; McCrory, De Brito, & Viding, 2012; Reichborn-Kjennerud et al., 2013). A range of childhood and parental demographic characteristics, adverse childhood experiences, including neglect, trauma and abuse, early interpersonal difficulties and forms of maladaptative parenting have been identified as risk factors for adolescent and adults with BPD (De Clercq & De Fruyt, 2007; De Fruyt & De Clercq, 2014; Hernandez, Arntz, Gaviria, Labad, & Gutiérrez-Zotes, 2012; Martín-Blanco et al., 2014; NICE, 2009; Wingenfeld et al., 2011). These patients frequently report early negative events during childhood and substantially more adverse events than patients with other personality disorders (Zanarini, Frankenburg, Reich, & Fitzmaurice, 2010; Zanarini & Frankenburg, 1997). Within this view, some etiological models consider different types of environmental risk factors. For example, Linhean (1993) proposed a model in which family history of psychopathology, problematic parent-child relationships (emotional invalidation, attachment disturbance and maltreatment), and social risk (e.g. income, culture background) provide an increased psychosocial risk to the development of BPD (Crowell, Beauchaine, & Linehan, 2009). Although a high correlation between childhood trauma and the development of BPD latter in life has been shown in a number of studies, the mechanisms involved are still under debate.

Taken as a whole, the present evidence suggests that BPD is currently understood to be caused by a combination of biological factors (e.g., genetic temperamental vulnerabilities) and early environmental influences (e.g., adverse childhood experiences). Future research on BPD etiological mechanisms should aim to investigate how genetic and psychosocial factors may interact with

neurotransmitter functioning and brain structural abnormalities leading to the cognitive, behavioural and emotional dysregulation of this disorder.

2.1.7 Course and Prognosis

BPD natural course is characterized by a notable distress and functional impairment. These individuals often present an important difficulty with occupational, academic or role functioning (Skodol et al., 2005; Skodol, Gunderson, McGlashan, et al., 2002; Skodol, Siever, et al., 2002). Moreover, BPD patients show greater lifetime utilization of most major categories of medication and most types of psychotherapy than individuals with other personality disorders (Herpertz et al., 2007; Sanislow et al., 2009). Results from long-term follow-up studies with BPD patients indicate that its course can be very variable. Research suggests that BPD, or at least some of its symptoms, usually begins in the late latency period of childhood but treatment is typically not sought until late adolescence (Lieb et al., 2004). Frequently, BPD patients present numerous exacerbations of the clinical symptoms of the disorder like emotional dysregulation, impulsive aggression, repeated self-injury and suicidal behaviour, which make these patients frequent users of mental health resources (Leichsenring et al., 2011; NICE, 2009). Some follow-up studies suggested a decrease in impulsivity with age (Stevenson, Meares, & Comerford, 2003), while associated mood disorders and interpersonal difficulties appear to be persistent and chronic (Zanarini et al., 2007).

Although the evolution of the disorder is variable, a tendency towards improvement over time it has been described, so that after the fourth or fifth decade of life some stability in personal relationships and occupational functioning is achieved (Grupo de trabajo de la guía de práctica clínica sobre trastorno límite de la personalidad, 2011). While some authors suggest that the functional impairment associated with this disorder appears to be a relatively enduring feature of the disorder (Skodol et al., 2005; Skodol et al., 2002), more recent follow-up studies indicate a clear tendency

towards improvement and in some cases remission of diagnostic criteria over time (Gunderson et al., 2011; Paris & Zweig-Frank, 2001; Zanarini, Frankenburg, Reich, & Fitzmaurice, 2010, 2012).

A 27-year follow-up study carried out by Paris & Zweig-Frank (Paris & Zweig-Frank, 2001) found that only 8% of patients maintained the diagnosis of BPD, and suggested that about 75% of patients would recover adaptive functioning by the age of 40 years, and 90% at the age of 50. Zweig-Frank & Paris (2002) found that the levels of functioning at 15-years of evolution are more useful predictors of long-term outcome than other psychological baseline variables. Two of the major longitudinal studies documenting the natural history of this disorder, the Collaborative Longitudinal Personality Disorders Study (Gunderson et al., 2011) and the McLean Study of Adult Development have (Zanarini et al., 2010) followed their respective cohorts of BPD patients for more than 10 years each. The work by Zanarini and colleagues (2010) found that 50% of BPD patients achieved recovery, an outcome that required being symptomatically remitted and having good social and vocational functioning for at least two years. Moreover, 93% attained symptomatic remission lasting at least 2 years, and 86% attained a sustained remission lasting at least 4 years. Similarly, Gunderson's group (2011) 10-year follow up study found that 85% of BPD patients remitted, although slower than patients with major depression and other personality disorders, and only 12% of BPD patients relapsed. Relating social functioning, results showed significant impairment with only modest improvement. More recently, the 16-years follow up study by Zanarini's group (Zanarini et al., 2012) reported similar results, concluding that sustained symptomatic remission is substantially more common than sustained recovery from BPD.

Although the mechanism of recovery in BPD is not fully understood, major prospective studies of BPD indicate a tendency to recovery over time. Taken together, the findings from these prospective studies reveal that approximately 85-90% of BPD individuals experience symptom remission within a 10-year period. However, psychosocial functioning often remains impaired (Gunderson et al.,

2011; Zanarini et al., 2010, 2012). At least in some of these prospective studies many of the participants received treatment or formal psychiatric therapy. In this sense, it is not known to what extent this is a consequence of treatment; evidence suggests that a significant proportion of improvement is spontaneous and accompanied by greater maturity and self-reflection (NICE, 2009). In any case, the majority of prospective studies suggest that even though the characteristics of the disorder may be present throughout the life of BPD patients, the symptom intensity seem to decline. As a result, some have questioned the stability over time of the BPD diagnosis given that improvement generally means no longer meeting diagnostic criteria.

2.1.8 Treatment and management

BPD was considered to be a chronic ongoing condition with a poor prognosis and no effective treatment. However, recent research suggests that the prognosis for BPD can be considered improved if one of a number of effective treatments is implemented (Grenyer, 2013). Psychotherapy is regarded as the first-line treatment for people with BPD, and pharmacotherapy is recommended as an adjunctive component of treatment that target state symptoms during periods of acute decompensation and trait vulnerabilities (Leichsenring et al., 2011; Stoffers et al., 2012). Pharmacotherapy is mainly directed towards three clusters of symptoms: cognitive-perceptual symptoms, affective symptoms and impulsive behavioural dysregulation (Herpertz et al., 2007; Leichsenring et al., 2011; Pascual et al., 2007).

During the past two decades several specialized therapies for BPD patients have been developed, and there are indications of beneficial effects for both comprehensive psychotherapies as well as non-comprehensive psychotherapeutic interventions for BPD core pathology and associated symptoms (Allilaire, 2012; Stoffers et al., 2012). Among comprehensive psychotherapies in BPD, the most intensively studied are Dialectical Behaviour Therapy (DBT), Mentalization-Based Treatment (MBT), Transference-Focused Psychotherapy (TFP), followed by Cognitive Behavioural

Therapy (CBT), Schema-Focused Therapy (SFT) and Systems Training for Emotional Predictability and Problem Solving (STEPPS) (Stoffers et al., 2012).

Probably the interventions that have more studies demonstrating its efficacy in BPD are DBT, MBT and TFP (Clarkin, Yeomans, & Kernberg, 2007; Yen et al., 2009). A recent review study suggested that the effectiveness of these models could lie on the fact that all propose a similar biopsychosocial understanding of BPD etiology, a focus on synthesizing opposing affects and mental states, and on increasing the patient's ability for mindfulness or reflection (Bliss & McCardle, 2013). Dialectical Behaviour Therapy seems to be a very effective treatment for BPD for a wide range of symptoms and in different settings (Bliss & McCardle, 2013; Kliem, Kröger, & Kosfelder, 2010; O'Connell & Dowling, 2013; Soler et al., 2009). It is a well-studied model with more randomized control trials in comparison to other therapies. This therapy developed by Linehan (1993) conceptualizes BPD development as stemming from interacting biological and environmental factors that may contribute to distortions in thinking and difficulty in emotion regulation. The DBT integrates the core conditions of acceptance and change into a 'dialectical' process that intends to develop various 'skills' to improve mindfulness, interpersonal effectiveness, emotional regulation, and distress tolerance (Linehan, 1993). It has demonstrated its effectiveness in addressing a number of behavioural, cognitive and emotional symptoms of BPD, including suicide attempts, hospitalizations, and medication use and in overall improved functioning (Weinberg, Ronningstam, Goldblatt, Schechter, & Maltsberger, 2011). On the other hand, Mentalization-Based Treatment is an alternative form of psychodynamic therapy that has been found to be effective in the treatment of BPD patients (Bateman & Fonagy, 2008, 2010). It was developed to increase mentalization capacity in order to achieve a better emotional regulation and interpersonal functioning. MBT seeks to enhance this reflective capacity, which is supposed to be disrupted in patients with BPD, particularly in the context of relationships that activate their attachment system, and underlies their disturbed interpersonal relatedness. Lastly, Transference-Focused Psychotherapy (TFP) is based on

Kernberg's (Kernberg, 1985) object relation model of BPD, in which the primary difficulty in these patients is that high levels of negative emotion and aggression interfere with the normal development process of integrating negative and positive internal representations of the self and others (Levy et al., 2006). TFP intends for total recovery, and encompasses reducing suicidality and self-injurious behaviour, improving behavioural control and effect regulation, and enhancing the ability to pursue gratifying relationships and meaningful life goals. The effectiveness of this therapy in BPD was supported in decreasing suicide attempts, decrease hospitalizations and emergency services visits and improves psychosocial functioning (Weinberg et al., 2011).

Meta-analysis of existing trials confirms that these interventions are effective for most aspects of BPD psychopathology and functioning (Bliss & McCardle, 2013; Kliem et al., 2010; Weinberg et al., 2011). In general, the evidence for BPD treatments seems to support that a number of different treatments methods may be successful for this disorder. Yet, the evidence does not seem to indicate a particular superiority of a given treatment in relation to another (Stone, 2010; Zanarini, 2009), and these approaches seem to have about equal efficacy in symptom reduction. An important aspect that seems to be common to the therapies demonstrating their efficacy is the use of a specific form of communication focused on discussing current relationships difficulties and methods of problem solving with these patients. Zanarini and collegues (2010) suggest that too much emphasis has been done on symptom reduction in BPD and not enough on psychosocial rehabilitation, which requires attention to the less readily modifiable personality traits abnormalities in BPD patients.

2.2 IMPULSIVITY IN BORDERLINE PERSONALITY DISORDER

2.2.1 Impulsivity in BPD: general introduction

Impulsivity is, along with emotional dysregulation, regarded as a core feature of BPD and a central aspect in the understanding of the nature of BPD psychopathology (Bornovalova et al., 2005; Links et al., 1999; Paris, 2005a, 2007). It was previously implicated in BPD morbidity and mortality, since it was associated with factors contributing to the severity of the disorder, such as suicidal behaviour (Jimenez-Treviño, Blasco-Fontecilla, Braquehais, Ceverino-Dominguez, & Baca-Garcia, 2011; Oquendo & Mann, 2000; Wilson, Fertuck, Kwitel, Stanley, & Stanley, 2006a) or an increased risk of substance dependency (Oldham, 2006; Paris, 2002; Wilson, Fertuck, Kwitel, Stanley, & Stanley, 2006b). Impulsivity is a key component of neurobehavioural models of the disease (Berlin et al., 2005; Krause-Utz et al., 2014; Soloff, Kelly, Strotmeyer, Malone, & Mann, 2003), and suggested to be an important endophenotype used in genetic research (Amad et al., 2014; Bevilacqua & Goldman, 2013). Furthermore, impulsivity seems to be stable over time and a predictor of the longitudinal course of borderline symptomatology (Zweig-Frank & Paris, 2002).

According to the DSM-IV-TR (2000), impulsivity is one of the nine diagnostic criteria for BPD (criterion 4, see Table 1). This criterion is present since the inclusion of BPD in DSM in its third version (1980), and refers to behaviours with unintended self-destructive results. In DSM-III impulsivity in at least two potentially self-damaging areas was necessary to fulfil this criterion, like over-spending, unprotected sex, gambling, substance abuse, shoplifting, overeating, or physically self-damaging acts. In its later revision in DSM-III-TR, gambling and overeating were substituted by reckless driving and binge eating. In DSM-IV-TR (APA, 2000), recklessly impulsive behaviour is directly assessed by one of the criteria of BPD. However, other BPD criteria are suggestive of impulsivity, for e.g. frantic efforts to avoid abandonment, unstable relationships, affective instability, and difficulty controlling anger. In clinical practice it is evident that this group of

patients is especially impulsive, that is, display risky or careless behaviours without consideration of long-term consequences. Aggressive behaviours are also typical expression of BPD psychopathology and very related to impulsivity. Some authors refer to this dimension as impulsive aggression, a feature related to unstable interpersonal relationships, inappropriate anger and potentially self-damaging behaviours typically found in borderline patients (García-Forero et al., 2009; Goodman & New, 2000; Látalová & Prasko, 2010; Scott, Stepp, & Pilkonis, 2014; Wilson et al., 2007).

2.2.2 Definition of Impulsivity

Although there is not a commonly accepted definition of impulsivity (Moeller et al., 2001; Stanford et al., 2009), several authors attempt to provide its definition in an intent to capture its complexity and multidimensional nature. Impulsiveness is a broad personality trait characterized by spontaneous, poorly planned or situationally inappropriate behaviours (Evenden, 1999). One of the most comprehensive approaches to impulsivity was developed by Barratt and colleagues (Barratt, 1994), including information from medical, psychological, behavioural and social models. These authors identified three higher-order factors which reflect the different components of impulsivity: attentional impulsiveness (the ability to focus on the tasks at hand and cognitive instability), motor impulsiveness (acting on the spur of the moment and perseverance), and non-planning (self-control and cognitive complexity). Later, Moeller and cols. (2001) combined characterological, cognitive and behavioural aspects of impulsivity using a biopsychosocial perspective. These authors defined impulsivity as a predisposition towards rapid, unplanned reactions to internal or external stimuli without considering the negative consequences of these reactions to the impulsive individual or to others. In sum, general definition of impulsivity should include 1) decreased sensitivity to negative consequences; 2) rapid, unplanned reactions to stimuli before complete processing of information; and 3) lack of regard for long-term consequences.

In addition, all main personality theories incorporate a conceptualization of impulsivity that intent to clarify its nature. For instance, Eysenck & Eysenck (1985) in their three dimensional model personality include impulsiveness as a component of psychoticism and venturesomeness and sensation-seeking as components of extraversion. Buss & Plomin (1975) in their four model of temperament hypothesize that impulsivity is a multidimensional temperament related to inhibitory control defined as the ability to delay the performance of behaviour. Similarly, the seven factor model of personality developed by Cloninger and colleagues (Cloninger et al., 1993) includes a factor of impulsivity in the temperament dimension of novelty seeking, which includes features of thrill seeking and preferring to act on feelings of the moment without regard for rules and regulations. Impulsivity is conceptualized as an automatic response to novel stimulus that occurs at a preconscious level due to biological tendencies. In addition to impulsivity, novelty seeking dimension also includes traits of exploratory activity in response to novelty, extravagance in approach to reward cues, and the tendency to a quick loss of temper and avoidance of frustration.

2.2.3 Impulsivity and impulsive aggression in BPD

Impulsive behaviour assumes a rich variety of modes of expression suggesting that impulsivity is not a unitary construct. In fact, there is now general agreement that impulsivity is a complex multidimensional construct that relates to other personality traits like aggression and impulsive aggression (Bari & Robbins, 2013; Bornovalova et al., 2005). Definitions of impulsivity construct do not generally make an explicit reference to aggressive behaviour. However, several authors have often suggested that impulsivity can lead to self-destructive and aggressive actions characteristic of BPD patients (García-Forero et al., 2009; Paris, 2005b), and thus be expected to correlate with some forms of aggression, particularly non-premeditated 'impulsive-aggression'.

According to some authors, impulsiveness and impulsive-aggression are heritable traits of temperament that may contribute to the development of BPD (Lieb et al., 2004; Skodol, Gunderson,

Pfohl, et al., 2002). However, although they share a common underlying behavioural dimension they are different constructs (Critchfield et al., 2004; García-Forero et al., 2009; Ramírez & Andreu, 2006; Zetzsche et al., 2007). This postulation leads to some authors to theorize that impulsivity and aggression are expected to appear together on the phenotypic level, leading to the indiscriminate use of the term impulsive-aggression to simply refer to impulsivity and/or aggression. Conversely, Critchfield and cols. (Critchfield et al., 2004) examined the relationships between multiple measures of impulsivity, aggression and impulsive aggression in a BPD sample. The authors found that impulsive-aggression is more closely related to irritability and aggression than with impulsivity. The results of this study do not support the theory of impulsive-aggression as a single phenotypic trait. Instead, they suggest that although related, impulsivity and impulsive-aggression are two independent constructs that should be distinguished and assessed independently. Even so, the boundaries of each and the precise relation between these constructs can be unclear and has lead to inconsistencies in the literature.

Impulsive aggression is characterized by an inability to regulated affect as well as aggressive impulses, and is related to the constructs of aggressiveness and hostility (McGirr et al., 2008). It has been defined as a tendency to react with animosity or over hostility without consideration of possible consequences (Goodman & New, 2000; Guyll & Madon, 2003). In BPD, this can be related also with the intense feelings of anger and difficulties to control it, as well as aggressive outbursts or irritability. Moreover, aggressive behaviour is generally conceptualized by either premeditated aggression (instrumental) or impulsive (unplanned aggression) (Látalová & Prasko, 2010). While instrumental aggression is a planned action aimed to achieve a goal; impulsive aggression is not planned, is caused by a lack of behavioural inhibition and unconcern about the consequences. Thus, impulsive behaviour, including impulsive aggression, differs from corresponding premeditated behaviour by having an inappropriately short threshold for response, lack of reflection, lack of modulation, and lack of potential gain, leading to dissociation between an

action and its intent (Swann et al., 2005). In BPD, impulsive aggression seems to be related to an unplanned aggressive behaviour generally defined as a hair-trigger aggressive response to provocation with loss of behavioural control (García-Forero et al., 2009). While traits such as impulsivity and hostility may be precursors of aggressive acts, they may not be sufficient as a cause of aggressive behaviour, nor necessary conditions for all types of aggressive behaviour (Critchfield et al., 2004; Látalová & Prasko, 2010; Ramírez & Andreu, 2006).

2.2.4 Empirical findings in impulsivity in BPD: self-report measures

There is a wide variety of questionnaires designed to assess impulsivity. The Barratt Impulsivity Scale (Barratt, 1994; Patton, Stanford, & Barratt, 1995) is one of the most used and well-established instruments in impulsivity research, and it was previously recommended by BPD researches (Skodol, Gunderson, Pfohl, et al., 2002; Stanford et al., 2009). This questionnaire is designed to assess general impulsiveness and three of its facets: motor, nonplanning, and attentional impulsiveness. Motor impulsiveness refers to acting without thinking, measuring behavioural spontaneousness such as buying things spontaneously. Nonplanning impulsiveness refers to being present-oriented or lacking in being future-oriented, describing a lack of action planning on the level of a general attitude towards life, such as a low interest in one's future. Finally, attentional impulsiveness is defined as a tendency towards quick reactions and a lack of attention and cognitive control, it refers to impulsive thinking and difficulty with concentration (Patton et al., 1995). Different studies found that when assessed by the BIS, BPD patients report high levels across all of the three facets of impulsiveness (Kunert, Druecke, Sass, & Herpertz, 2003; Paris, 2005b). Higher values on the BIS were found for BPD as compared with healthy control subjects (Berlin et al., 2005; Domes et al., 2006; Dougherty, Bjork, Huckabee, Moeller, & Swann, 1999; Jacob et al., 2010; Rentrop et al., 2008; Sebastian et al., 2013), with patients suffering from other personality disorders or bipolar II disorder (Henry et al., 2001), and patients with major depression (Wilson et

al., 2007). It has been reported higher impulsivity scores in BPD compared to subjects suffering from orbitofrontal cortex lesions (Berlin et al., 2005). Occurrence and severity of the BPD symptoms were shown to be correlated with impulsivity as measured by the BIS (Fossati et al., 2004).

Impulsive aggression can be assessed as a component of behavioural and attitudinal hostility using the Buss-Durkee Hostility Inventory (BDHI, Buss & Durkee, 1957), one of the most used scales to measure aggressiveness and hostility and also used to indicate impulsive aggression (Bornovalova et al., 2005; Lynam, Miller, Miller, Bornovalova, & Lejuez, 2011; Soloff et al., 2000). This instrument was previously recommended for BPD study (Skodol, Gunderson, Pfohl, et al., 2002) and it is a useful instrument for measuring both the experience and the expression of hostility. The BDHI provides a total hostility score and eight subscores in assault, indirect hostility, irritability, negativism, resentment, suspicion, verbal hostility and guilt. Using the BDHI results consistently demonstrated that BPD patients were characterized by high levels of hostility across various dimensions related to attitudinal and behavioural hostility (Critchfield et al., 2004; Goodman & New, 2000; Hochhausen, Lorenz, & Newman, 2002; Keilp et al., 2006; Látalová & Prasko, 2010; Lawrence, Allen, & Chanen, 2010; McCloskey et al., 2009; Wilson et al., 2007).

In addition, impulsivity conceptualized as an aspect of novelty seeking can be assessed using the Temperament and Character Inventory (TCI (Cloninger et al., 1993), a questionnaire designed to measure biologically influenced temperament traits, as well as more complex and broad character dimensions. Cloninger (1987) suggested that impulsive aggression can be observed clinically as a combination of high novelty seeking and high harm avoidance, a dimension that reflects individual differences in inhibited behaviour. Measures of these two dimensions assess sensitivity to social cues and a tendency to persist with tasks despite frustration, respectively. A particular constellation of temperament traits of high novelty seeking and high harm avoidance could be a reflection of an

approach-avoidance conflict (Joyce et al., 2003; Svrakic et al., 1993), which could be characteristic in BPD patients. Fossati et al. (2007) suggested that novelty seeking, together with impulsivity and aggressiveness, are a common underlying component of Cluster B personality disorders. According to this study, impulsive traits were selectively associated with BPD, whereas different aspects of aggressiveness were useful in discriminating Narcissistic from Antisocial Personality Disorder. Furthermore, using the TCI-R, several research found that BPD patients are characterized by high levels of novelty seeking and high harm avoidance (Barnow et al., 2006; Fassino et al., 2009; Joyce et al., 2003; Kaess et al., 2013; Steinmeyer et al., 2002), indicating that these temperament dimensions may be altered in BPD patients and could be an indicator of poor impulse control combined with the tendency to high emotional sensitivity.

2.2.5 Empirical findings in impulsivity in BPD: Laboratorial behavioural measures

Considering the impulsive dysregulation in BPD patients, it is of great interest to study the cognitive processes involved in this disorder. It has been suggested that individuals with BPD show executive or, more precisely, inhibitory dysfunction which is thought to be related to prefrontal disturbance in this disorder (Domes et al., 2006; Hochhausen et al., 2002; Krause-Utz et al., 2013; Legris, Links, van Reekum, Tannock, & Toplak, 2012; LeGris & van Reekum, 2006; Wilson et al., 2006a). However, results have been mixed and it is not clear whether neuropsychological dysfunction plays a role in BPD, or if this dysfunction is related to certain personality traits like impulsivity and aggressiveness.

Rapid-response model of impulsivity is one of the dominant models based on animal studies that defines impulsivity as an inability to act without adequately assessing the context (Swann, Bjork, Moeller, & Dougherty, 2002) leading to errors of commission on tests that required careful checking of the stimuli (Evenden, 1999). Among the rapid-decision paradigms, laboratory-based assessments of executive neurocognition are useful instruments for an integral approach to research

in BPD. These measures provide a more objective marker of impulsive behaviour and additional information to self-report measures. In the light of these models, impulsivity is viewed as a failure of the inhibitory process, and generally regarded as a consequence of impaired executive function. Different studies indicate that rapid-response laboratorial tests assessing behavioural disinhibition are considered suitable measures of impulsivity (Dougherty, Bjork, Harper, et al., 2003; Dougherty, Mathias, Marsh, & Jagar, 2005; Rentrop et al., 2008).

There are multiple laboratory tasks designed to induce behavioural reactions by means of experimental procedures, in which impulsivity is assessed as a premature response made before information is completely processed or as a lack of inhibition. Several paradigms can be used to its assessment, such as behavioural response inhibition (e.g. Go/No-Go), cognitive interference (e.g. Stroop), more complex paradigms like risky decision making (e.g. Iowa Gambling Task) in planning tasks, or other tasks assessing impulse control in paradigms such as delayed gratification (Dougherty et al., 2005). Generally, higher impulsivity seems to be associated with a deficit in response inhibition (Dougherty, Bjork, Harper, et al., 2003; Moeller et al., 2001) and previous research have reported an impaired response inhibition in patients with BPD (Dell'Osso et al., 2010; Feliu-Soler, Soler, et al., 2013; Krause-Utz et al., 2013). Motor (or behavioural) impulsivity is equivalent to response inhibition and has been measured with a variety of instruments such as the go/no go, the continuous performance tests, or stop tasks (Dougherty et al., 2005), also previously associated with impairments in dorsolateral prefrontal cortex (Bechara, Tranel, & Damasio, 2000). The Continuous Performance Tests (CPT) provide information on attentional processing, cognitive efficiency and impulsivity. In this measure, impulsive behaviour is defined as a response to a particular stimulus that is similar (but not identical) to the designated target (Dougherty, Bjork, Harper, et al., 2003; Dougherty et al., 2005). Commission errors result from anticipatory, or incomplete processing of the stimulus leading to a rapid but incorrect response to the stimulus that is similar to the target. Elevated frequencies of commission errors are thought to indicate impulsive

responding and a number of CPT studies have shown elevated rates of commission errors in impulsive populations (Dougherty et al., 2003), and to correlate with self-reported impulsivity (Aragues, Jurado, Quinto, & Rubio, 2011; Hagenhoff et al., 2013; Riccio, Waldrop, Reynolds, & Lowe, 2001; Rubio et al., 2007). Finally, there is some evidence of familial transmission for commission errors in a CPT variant, supporting the heritability of the performance on this task (Dougherty, Bjork, Moeller, et al., 2003).

In BPD, previous clinical and experimental studies investigating impulsivity provided mixed results. Some studies found that behavioural measures of impulsivity appear to discriminate individuals with BPD from healthy controls (Chapman, Derbidge, Cooney, Hong, & Linehan, 2009; Hochhausen et al., 2002; Rentrop et al., 2008), suggesting a possible dysfunction in the inhibitory control in BPD individuals. However, other investigations report no significant evidences of impairment in response inhibition in BPD patients (Hagenhoff et al., 2013; Jacob et al., 2010; Kunert et al., 2003; Lawrence et al., 2010; Lazzaretti et al., 2012; Sebastian et al., 2013). For example, Lenzenweger, Clarkin, Fertuck, & Kernberg, (2004) examined the differences in CPT performance in BPD patients compared to normal controls but failed to find any significant differences. Similarly, Jacob and colleagues (Jacob et al., 2010) assessed impulsivity using self-report scales and behavioural inhibition tasks (Stroop task, an antisaccade task and a stop signal task) to compare different data level in a sample of fifteen women with BPD, and matched healthy controls. They found that patients with BPD scored significantly higher on self-report measures as compared to healthy controls, but not in behavioural tests, reporting a discrepancy between self-report and behavioural data, also reported elsewhere (Domes et al., 2006; Stanford et al., 2009). These inconsistencies in relation to neurocognitive impairment were also found in other behavioural domains in BPD patients. For example, Lazzaretti et al., (2012) suggested the presence of working memory deficit in BPD patients, however, no differences were found in CPT performance. Similarly, studies focusing in cognitive inhibition using a Stroop paradigm have also reported group

differences in BPD samples (de Bruijn et al., 2006) but others fail to find any differences (Domes et al., 2006; Lampe et al., 2007). More recently, Feliu-Soler et al. (2013) explored differences in attention and impulsivity among BPD subjects compared to a clinical and a healthy control group using a CPT, and found that BPD patients presented deficits in both domains. Furthermore, BPD patients also showed a reduced ability to discriminate stimuli which could be suggestive of an impaired selective attention.

In summary, there is conflicting evidence regarding response inhibition in patients with BPD. Although it has been suggested that individuals with BPD may show a possible dysfunction in the inhibitory control, results are fairly inconsistent and other investigations report no significant evidences of impairment in BPD patients. Moreover, few studies have used these instruments combined with laboratorial-based measures of impulsivity in BPD patients, and there seems to be a discrepancy between self-report and behavioural data in relation to impulse control and BPD. Given the inconsistency in neuropsychological findings in BPD and concretely in impulsive behaviour, it becomes necessary to clarify previous results in order to accomplish a complete understanding of the role of impulsivity dimension in BPD.

2.3 SUICIDAL BEHAVIOUR IN BORDERLINE PERSONALITY DISORDER

Suicide is a complex behaviour that is probably the final result of the interaction of several different factors. The presence of psychopathology is probably the single most important predictor of suicide. Consequently, approximately 90% of suicide cases meet criteria for a psychiatric disorder (Kolla et al., 2008). BPD is a mental disorder associated with suicidal behaviour and recurrent suicidal behaviour is a diagnostic criterion for BPD.

From the inclusion of BPD in DSM-III (APA, 1980) to the present DSM-5 (APA, 2013), recurrent suicidal behaviour has persisted as a diagnostic criterion for BPD. In fact, BPD is the only personality disorder to have recurrent suicidal or self-injurious behaviour among its diagnostic criteria. It has been suggested that the high rates of suicidal behaviour observed in these patients is a reflection of how the disorder is defined. Within this context, some authors suggested that in the absence of this criterion, we could expect lower rates of suicidal behaviour in BPD, since individuals could qualify for the diagnosis without necessarily having a history of suicidality. Nonetheless, empirical data indicate that suicidality and self-harming behaviours have always been part of BPD conceptualization. For example, Sanislow et al (Sanislow et al., 2002) published a three-factor solution for BPD criteria and reported that the criteria for impulsivity and suicidality or self-harming behaviour formed one of three factors of the disorder which they labelled as 'behavioural dysregulation'. In sum, the literature reveals that BPD individuals are a high-risk population to commit suicidal behaviours and completed suicide, and this disorder represents a high-risk, clinically relevant model for the study of suicidal behaviour (Soloff & Chiappetta, 2012b). Given the high rate and potential lethality of suicide attempts among BPD individuals, it is crucial to understand which factors might increase the likelihood of attempting suicide in this population so as to improve the methods for intervention and prevention.

2.3.1 Epidemiology of suicide and suicidal behaviour in BPD

In BPD research and also in clinical practice, it is frequent to use terms such as "gestures" or "threats" to nominate suicidal behaviour. The use of these terms may somehow imply that the risk of injury or death is low, which may underestimate the real risk of suicide in BPD patients (Black, Blum, Pfohl, & Hale, 2004). Contrarily, the literature shows that the risk of death by suicide is extremely high in this population, with a suicide completion rate between 3% and 10% depending

on the study (APA, 2006; Paris & Zweig-Frank, n.d.; Soloff et al., 2000; Zanarini et al., 2008; Zweig-Frank & Paris, 2002), which is approximately 50 times greater than the general population.

Moreover, BPD patients represent a total of 9% to 33% of all suicides (Kolla et al., 2008). Tidemalm and colleagues (Tidemalm, Elofsson, Stefansson, Waern, & Runeson, 2005) conducted a large community-based study in a cohort of adults with long-term disabling mental disorders in order to identify variables associated with completed suicides. Among those individuals with history of inpatients psychiatric care, a diagnosis of BPD was found to be the strongest diagnostic predictor of suicide. Forman et al (Forman, Berk, Henriques, Brown, & Beck, 2004) compared single suicide attempters and multiple suicide attempters and found that multiple suicide attempters were more likely to be diagnosed with BPD.

Concerning suicide attempts, recurrent suicidal behaviours are the BPD feature that probably makes the greatest demand on mental health resources (Soloff et al., 2000). A history of suicidal behaviour is found in 60%-78% of individuals with BPD (Kolla et al., 2008; Zanarini et al., 2008), and some studies report to occur in up to 84% of patients with BPD (Soloff et al., 2002), with a mean of 3.4 lifetime attempts per individual (Brodsky, Groves, Oquendo, Mann, & Stanley, 2006; Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994; Soloff et al., 2002). Suicide attempts in BPD individuals can have the same degree of lethality and intent to die as those by individuals without the disorder (Brown, Comtois, & Linehan, 2002; Oumaya et al., 2008). Soloff et al. (2000) found that patients with BPD (including those with comorbid depression) reported greater lethality for their most serious lifetime suicide attempt that those with depression alone. It is important to distinguish suicide acts from self-mutilation or deliberate self-harm. Suicide attempts are performed with some evidence of intent to die while nonsuicidal self-injury behaviours (self-harming behaviours) can be potentially life threatening but are not generally motivated by a desire to die (Oldham, 2006).

2.3.2 Risk factors for suicidal behaviour in BPD

Although a high percentage of BPD patients present suicidal behaviours, not all patients with BPD attempt suicide. Other factors must therefore play a role in increasing the suicide risk in these patients. Several risk factors for suicide attempts among BPD individuals have been identified. The presence of comorbid psychiatric disorder has showed to increase the risk of suicidal behaviour in BPD (Allen & Links, 2012; Links & Eynan, 2013), especially major depressive disorder (Beth S Brodsky et al., 2006; Soloff et al., 2000), substance use disorder (Lim et al., 2012; Wilson et al., 2006a) and post-traumatic stress disorder (Pagura et al., 2010; Pietrzak, Goldstein, Southwick, & Grant, 2011). A review by Geissbuhler and Links (2009) identified the strongest predictors of suicide attempts in BPD as a history of suicide attempts, childhood sexual abuse, and psychiatric hospitalizations, as well as low social adjustment. Younger age has also been associated with increased suicide attempts in BPD (Stepp & Pilkonis, 2008) (Stepp & Pilkonis, 2008), and also for completed suicide (Kolla et al., 2008). However, this observation could be reflective of the fact that the severity of symptoms tends to decrease later in adulthood for the majority of patients (Soloff & Chiappetta, 2012a).

A history of previous suicidal behaviours is one of the strongest predictors of complete suicide and future suicide attempts in BPD patients (Chesin, Jeglic, & Stanley, 2010; Geissbühler & Links, 2009; Soloff & Chiappetta, 2012b). Among attempters and across diagnoses, individuals with higher numbers of prior attempts are at an increased risk for completing suicide (Holmstrand, Niméus, & Träskman-Bendz, 2006). While only 10%-15% of suicide attempters become completers, 30%-40% of completers have history of previous suicide attempts (Soloff & Chiappetta, 2012b). In fact, previous studies seem to indicate that in BPD patients risk factors for attempted and completed suicide largely overlap (Black et al., 2004; Kolla et al., 2008). Some studies suggested that the outcome may be determined in part by seriousness of intent and degree of medical lethality, and high-lethality attempters with BPD share many characteristics with patients

who complete suicide (Alexander McGirr, Paris, Lesage, Renaud, & Turecki, 2007; Soloff et al., 2014).

Results of longitudinal investigations for suicidal behaviour in BPD have yield mixed results. Soloff & Chiappetta (2012a) have conducted a 6-year follow-up prospective study of risk factors for suicide attempts in BPD and their stability over time. The risk of suicide attempt was increased by low socioeconomic status, poor psychosocial adjustment, family history of suicide, previous psychiatric hospitalization, and absence of any outpatient treatment before the attempt. According to this study, risk factors predictive of suicide attempt seem to change over time. Acute stressors such as major depressive disorder were predictive only in the short term (12 months), while poor social function had persistent and long-term effects on suicide risk. Recently, Links et al. (2013) conducted a prospective cohort study to examine risk factors for suicide attempts in a treated sample of patients with BPD. These authors found that the number of previous suicide attempts and severity of childhood sexual abuse predicted suicide attempts during the first year of treatment. Similarly, number of suicide attempts, severity of childhood sexual abuse and number of hospitalizations predicted suicide attempts during the 2 years follow-up. Contrarily to Soloff and Chiappetta (2012a) study, the authors concluded that risk factors for BPD were fairly stable, largely non-modifiable, and unrelated to psychopathology or psychosocial functioning at baseline. Prior longitudinal studies, such as The Collaborative Longitudinal Personality Disorders Study have also identified some predictors of suicide attempts in BPD. Using data from a 8 years follow-up, this study identified specific symptoms of BPD as predictors of suicide attempts in borderline patients: self-harm (Yen et al., 2011), affective instability (Yen et al., 2004) and general negative temperament (Yen et al., 2009). Finally, the McLean Study of Adult Development (Wedig et al., 2012) conducted a 16-years follow-up study in BPD patients and found several variables to be significant predictors of suicide attempts. Specifically, results from multivariate analyses, identified diagnosis of major depressive disorder, substance use disorder, post-traumatic stress disorder,

presence of self-harm, adult sexual assault, having a caretaker who has completed suicide, affective instability, and severe dissociative experiences as significant predictors. As the authors note, prediction of suicide attempts in BPD individuals is complex, and seems to involve several different factors.

2.3.2.1 Personality traits: Impulsivity and impulsivity-related traits

Among the factors suggested to play a role in an increased suicide risk are personality traits such as impulsivity and aggressiveness. Both impulsivity and aggression have been associated with suicidal behaviour across diagnoses (Carballo et al., 2006; Conner, Swogger, & Houston, 2009; Horesh, Gothelf, Ofek, Weizman, & Apter, 1999; Lynam et al., 2011) as well as in BPD (Brodsky, Malone, Ellis, Dulit, & Mann, 1997; Carpiniello et al., 2011; Chesin et al., 2010; Evren, Cinar, Evren, & Celik, 2011; Giegling et al., 2009; Rihmer & Benazzi, 2010; Soloff et al., 1994, 2000; Shirley Yen et al., 2004). Nonetheless, the link between these personality traits and suicide and suicidal behaviour appears to be complex.

Previous studies have identified impulsivity as a common correlate and risk factor for suicidal behaviour. Impulsivity has been found to differentiate between attempters and nonattempters, since those who make attempts have been found to have higher levels of impulsivity (Horesh et al., 1999; Netta Horesh, Nachshoni, Wolmer, & Toren, 2009; Mann, Waternaux, Haas, & Malone, 1999). Other studies, have found that the co-occurring symptom of impulsivity has also been associated with increased suicide attempts in BPD (Brodsky et al., 1997; Chesin et al., 2010; Wedig et al., 2012). Moreover, increased impulsivity has been associated with an increased suicide risk among BPD individuals who also have aggressive or antisocial traits especially among younger completers (Horesh et al., 1997; McGirr et al., 2008). On the other hand, as a complex multifaceted construct, it is not clear which components of the construct of impulsivity associates with suicidality in BPD. Yen et al. (Yen et al., 2009) examined several facets of impulsivity, as a symptom of BPD, and

found that only the facet of lack of planning and premeditation was significantly associated with suicide attempt status. Conversely, others have fail to find an association between impulsivity and suicidal behaviours (Keilp et al., 2006; Soloff, Fabio, Kelly, Malone, & Mann, 2005; Soloff et al., 2008). These results has led some authors to suggest that impulsivity alone may not be the only predictor of suicidal behaviour (Carli et al., 2010; Perroud, Baud, Mouthon, Courtet, & Malafosse, 2011) and that aggression should be part of the construct associated with suicidal behaviour (Mann et al., 2009).

Along with impulsivity, aggression is one of the most concern risk factors for suicide and suicidal behaviours. It has been suggested that the influence of impulsive-aggressive traits is part of a developmental cascade that increases suicide risk, and that these personality traits seem to play a larger role among younger suiciders and may mediate familial transmission of suicidal behaviour (McGirr et al., 2008). Gvion et al. (2014) found that impulsivity and aggression distinguished between suicide attempter from non-attempters and that both traits seem important risk factors for suicidal behaviour. Other studies have found that trait aggression may act as a predictor of future suicide and elevated risk for suicidal behaviour (Yen, Gagnon, & Spirito, 2013). Similarly, Keilp et al. (2006) found that it was aggressiveness that held the most importance in predicting suicidal behaviour when stratifying by BPD. Anger, a construct often associated or interchanged with aggression (Brown et al., 2002; Giegling et al., 2009; Stringer et al., 2013), has also been found to be significantly correlated with suicide risk. In the same line, Zhang and collegues (2012) found that hostility, physical aggression and anger predicted suicidal behaviour among adolescences. More recently, some investigators have suggested that impulsivity and aggression may play an indirect role in high lethality attempts and completion (Chesin et al., 2010; Soloff et al., 2014). Others, as McGirr et al (2007) have suggested that the interaction of impulsivity and aggression may contribute to suicide completion in BPD. This case-control study reported that BPD subjects who died by suicide were reported by surviving relatives to have greater impulsivity and aggression

and more comorbid diagnoses of antisocial personality disorder than control patients who did not commit suicide.

Nonetheless, results on impulsivity and aggression have also yield some mix results. Oquendo & Mann (2000) found higher lifetime aggression in attempters than in non-attempters, but no difference in lifetime impulsivity as assessed by the BIS. Other researchers have found that aggression (Brodsky et al., 1997; Chesin et al., 2010; Soloff et al., 1994) or other related factors such as anger and hostility (Stanley et al., 2000) were not related to higher numbers of lifetime attempts among individuals with BPD. Chesin et al. (2010) studied some factors associated with high-lethality suicide attempts in BPD individuals in order to develop a model of high-lethality suicidal behaviour in this population. Their results indicated that impulsivity was directly related to the frequency of an individual's past suicidal behaviour and the medical seriousness of the index attempt. On the contrary, aggression was not significantly related to the frequency of an individual's past suicidal behaviour or the lethality of the index attempt, also reported by other studies failing to find predictive associations between attempts lethality and measures of both impulsivity and aggression (Baca-García et al., 2001; Soloff & Chiappetta, 2012a; Soloff et al., 2005, 2008). Ultimately, the contribution of impulsivity and aggression to the seriousness of suicide attempt has only lately been investigated in empirical studies, and results are diverse.

More broad temperament traits such as novelty seeking and harm avoidance were also investigated in suicidal research. Previous data have suggested that both temperament dimensions are associated to suicidal behaviours in BPD (Calati et al., 2008; Chapman et al., 2009; Giegling et al., 2009; Joyce, Light, Rowe, Cloninger, & Kennedy, 2010) as well as in other mental disorders (Conrad et al., 2009; McGirr et al., 2008; Pawlak et al., n.d.; Perroud et al., 2013; Sarısoy et al., 2012). McGirr et al. (McGirr et al., 2008) found that higher levels of impulsivity, lifetime history of aggression, and novelty seeking were associated with younger age of death by suicide, while increasing levels

of harm avoidance were associated with increasing age of suicide. Using the TCI, Giegling et al., (2009) tested the associations between anger, impulsivity and temperament/character dimensions as predictor of self-aggression in suicide attempters. They found that high impulsiveness and harm avoidance emerged as temperament dimensions independently associated with self-aggressive tendencies in personality. Similarly, harm avoidance was found to be a personality trait associated with suicide attempts in major depression (Conrad et al., 2009).

Recently, Perroud et al. (2013) compared a large sample of suicide attempters and non-suicide attempters suffering from different DSM-IV Axis I disorders using the TCI. Compared with non-attempters, suicide attempters scored higher in novelty seeking and harm avoidance, and lower for self-directedness, independently of Axis I disorders. Furthermore, the authors found that higher harm avoidance and novelty seeking scores were associated with a greater severity of suicidal behaviour. Finally, a multivariate model showed that harm avoidance was the single temperamental dimension independently related to suicide attempt history, beside impulsivity and anger-related traits.

In sum, novelty seeking and harm avoidance have been suggested as potential temperamental vulnerability factors to suicidal behaviour in BPD. Nevertheless, there seems to be a more consist evidence for the implication of harm avoidance temperament dimension in relation to suicide. Furthermore, the use of dimensional models of personality allows exploring the associations between extreme expressions of normal personality traits and self-destructive behaviours, which ultimately may improve our understanding about the complex interactions between suicide, personality and borderline pathology.

2.3.2.2 Early adverse experiences of abuse: Childhood sexual abuse

Suicidal behaviour is a complex phenomenon that seems to involve both genetic predispositions and environmental factors (Courtet, Gottesman, Jollant, & Gould, 2011; Gonda et al., 2011; Jimenez-Treviño et al., 2011; Roy, Sarchiopone, & Carli, 2009). Personal history of childhood abuse has been implicated as a risk factor for suicidal behaviour (Brezo et al., 2008; Brodsky et al., 1997; Carballo et al., 2006; Melhem et al., 2007). Among individuals with BPD, the high prevalence of early childhood adverse events has stimulated the investigation of the developmental consequences of childhood abuse and its role in the etiology of BPD (Lobbestael, Arntz, & Bernstein, 2010).

Individuals with BPD report many negative events during childhood, such as neglect (92%), sexual abuse (40-70%), physical abuse (25-73%) (Zanarini & Frankenburg, 1997; Zanarini et al., 2002); parental divorce or illness (Paris, Zweig-Frank, & Guzder, 1994), and parental psychopathology (Trull, 2001). It is estimated that between 30% and 70% of BPD patients present a history of childhood maltreatment, depending on the study (Hernandez et al., 2012; Lieb et al., 2004; Lobbestael et al., 2010; Martín-Blanco et al., 2014; Zanarini et al., 2002), with one study reporting up to 90% of patients having experienced emotional, physical and/or sexual abuse (Zanarini & Frankenburg, 1997). Moreover, these patients report more adverse events than patients with other personality disorders (Yen et al., 2002). Childhood adversity accounts for one of the largest proportion of variance explained (27.8%) compared to the nine other personalities disorder dimensions (Hengartner, Müller, Rodgers, Rössler, & Ajdacic-Gross, 2013). Accordingly, history of childhood abuse has been suggested to contribute to the psychopathology of BPD (Lieb et al., 2004; Links et al., 2013; Lobbestael et al., 2010; Sadikaj, Russell, Moskowitz, & Paris, 2010), and to its severity (Links & van Reekum, 1993; Silk, Lee, Hill, & Lohr, 1995; Zanarini et al., 2002).

Among early traumatic experiences, childhood abuse and especially childhood sexual abuse has been associated with self-destructive and suicidal behaviour latter in life (Chen et al., 2010; Trask,

Walsh, & Dilillo, 2011). Childhood sexual abuse has been demonstrated to be a very strong predictor of suicidal behaviour (Bedi et al., 2011; Brodsky et al., 1997; Geissbühler & Links, 2009; Horesh et al., 2009; Lim et al., 2012; Pérez-Fuentes et al., 2013; Soloff et al., 2008, 2002), remaining significant even after controlling for multiple psychiatric disorders including post traumatic stress disorder (Yen et al., 2004). Soloff et al. (2002) found that the occurrence and severity of childhood sexual abuse predicted suicidal behaviour independent of other known risk factors. In fact, this group has found that patients with history of this type of abuse had a 10 times more risk of suicidal behaviour than patients without such history. Childhood sexual abuse was previously associated with the risk for suicide thoughts and with an increased prevalence of psychiatric disorders (Bedi et al., 2011). Yen et al. (2013) found that sexual abuse history during childhood was a significant predictor for suicide events in an adolescent sample. There is also some evidence for a relationship between history of childhood sexual abuse and an increased risk of completed suicide (Plunkett et al., 2001). Moreover, some epidemiological studies have estimated that sexual abuse may explain 20% of the risk variance in suicide (Brodsky et al., 2008).

Ultimately, although there is a consistent amount of evidence suggesting the influence of childhood trauma to BPD development, it is unclear how such environmental factors could interact with existing biological temperamental predisposition in order to result in a greater likelihood of suicidal behaviours latter in life. It becomes necessary to further investigate and clarify the role of potential biological and inherited risk factors, such as personality traits, along with the presence of adverse childhood experiences, such as childhood sexual abuse, to suicidal behaviours in BPD.

3. AIMS AND HYPOTHESIS

3 AIMS AND HYPOTHESIS

3.1 STUDY 1.

General Aim

To characterize the impulsive dimension in BPD, by attending to the multidimensional nature of the construct impulsivity, and using different self-report measures of impulsivity and impulsivity-related traits together with a laboratorial behavioural measure.

Specific aims:

- To assess impulsivity and impulsivity-related traits using different self-report measures in BPD subjects.
- To determine if BPD subjects display deficits in response inhibition when assessed by a laboratorial behavioural measure of impulsivity.
- To explore the association between self-report impulsivity and laboratorial-based behavioural impulsivity in BPD subjects.

Secondary aim

- To characterize the dimensional personality profile in BPD subjects according to a dimensional model (Seven factors of personality).

Hypothesis

- BPD subjects would obtain higher levels of impulsiveness (as measured by the BIS-11), higher levels of aggressiveness/hostility (as measure by the BDHI), and higher Novelty Seeking (as measured by the TCI-R) comparing to a healthy control group.
- BPD subjects would perform poorer than healthy control subjects in the laboratorial behavioural measures of impulsivity due to an impaired response inhibition. More specifically, BPD subjects would show more commission errors than healthy controls.
- In BPD subjects, higher scores in self-report measures would be associated with higher number of commission errors in the laboratorial behavioural task.
- Comparing to healthy controls, BPD subjects would be characterized by higher Novelty Seeking and Harm avoidance temperament dimensions, and lower character dimensions of Self-Directedness and Cooperation (as measured by the TCI-R).

3.2 STUDY 2.

General Aim

To clarify the role of impulsivity and impulsivity-related traits in relation to suicidal behaviours in BPD individuals, and to study the relationship between suicidal behaviours and having suffered sexual abuse during childhood, so to determine the joint contribution of both psychological and environmental risk factors on suicidal behaviours in BPD.

Specific aims:

- To examine the relationships between impulsivity and impulsivity-related traits and suicidal behaviours in BPD subjects.
- To examine the relationship between history of childhood sexual abuse and suicidal behaviours in BPD subjects.

Hypothesis

- High levels of impulsiveness (as a stable trait of personality measured by the BIS-11) and high levels of hostility (as behavioural and emotional dimensions of trait hostility measured by the BDHI) would predict the presence and a higher number of suicide attempts in BPD subjects.
- High levels of temperament traits of Novelty Seeking and Harm Avoidance would predict the presence and a higher number of suicide attempts.
- Having suffered childhood sexual abuse would be associated with higher suicidality.

4 PUBLICATIONS

STUDY 1. Dimensional Assessment of Personality and Impulsiveness in Borderline Personality Disorder

Ferraz, L., Vállez, M., Navarro, J. B., Gelabert, E., MartínSubirà, & Susana-Santos, R. (2009). Dimensional assessment of personality and impulsiveness in borderline personality disorder. *Personality and Individual Differences.* doi:10.1016/j.paid.2008.09.017

STUDY 2. Hostility and Childhood Sexual Abuse as Predictors of Suicidal Behaviour in Borderline Personality Disorder.

Ferraz, L., Portella, M. J., Vállez, M., Gutiérrez, F., Martín-Blanco, A., Martín-Santos, R., & Subirà, S. (2013). Hostility and childhood sexual abuse as predictors of suicidal behaviour in Borderline Personality Disorder. *Psychiatry Research*, *210*(3), 980–5. doi:10.1016/j.psychres.2013.07.004

5. GENERAL DISCUSSION

5 GENERAL DISCUSSION

The results of this thesis revealed that BPD patients were characterized by increased levels of impulsivity and impulsivity related traits. Specifically, high impulsiveness as a broad personality trait in several of its domains, high levels of trait hostility/aggressiveness, and well as high novelty seeking temperament traits. Conversely, BPD individuals did not show an increased behavioural (motor) impulsivity nor exhibited deficits in response inhibition, as measured by the laboratorial behavioural task. Furthermore, no association was found between self-report and laboratorial behavioural measures of impulsivity. As for the dimensional personality profile, BPD subjects were characterized by high temperament traits of novelty seeking and harm avoidance, and low self-directedness and cooperation character dimensions. The results obtained by means of self-report measures were superior to laboratorial behavioural task, since it allowed discriminating between BPD and healthy control subjects, in several facets of impulsivity and in its related traits. In light of these results, we used the self-report instruments to investigate the relationship between these personality traits and suicidal behaviours in a sample of BPD individuals. The results indicated that BPD individuals with a previous history of suicidal behaviours were characterized by higher levels of behavioural and attitudinal hostility, and also in three of its facets, resentment, suspiciousness and guilt, in comparison to non-attempters BPD individuals. On the contrary, no differences were found in impulsiveness or in temperament traits of novelty seeking and harm avoidance between BPD attempters and non-attempters. Additionally, BPD patients with previous suicide attempts had a significantly high prevalence of childhood sexual abuse. Consistently, results from regression analyses indicated that increased hostility and having suffered sexual abuse during childhood predicted the presence, higher number and severity of suicide attempts, suggesting both variables as relevant risk factors for suicidal behaviours in BPD.

In the first study, BPD individuals reported higher motor, attentional and non-planning impulsiveness, suggesting that impulsivity in BPD seems to involve a lack of behavioural control and a tendency to act without anticipating the consequences (Patton et al., 1995), which is consistent with the severe behavioural dysfunction generally expressed by a pattern of risky impulsive behaviours in BPD. This result is also in line with previous research showing higher self-reported levels of trait impulsivity (Dougherty et al., 1999; Jacob et al., 2010; Lawrence et al., 2010; Paris et al., 2004; Wilson et al., 2007), and with studies indicating that these patients have difficulty delaying gratification, make decisions quickly, and either devalue or fail to consider the consequences of their actions (McCloskey et al., 2009). The rich variety of modes of expression of impulsivity suggests that impulsivity is not a unitary construct, and that definition of different forms of impulsivity could improve the understanding of the neurobiological basis of disorders for which impulsivity is a core symptom (Bevilacqua & Goldman, 2013). Moreover, this result provides further evidence to the assumption that impulsive actions in BPD seem to be an expression of a stable and enduring personality trait. Accordingly, previous longitudinal studies suggested that impulsivity in BPD seems to be stable over time and a predictor of the longitudinal course of borderline symptomatology (Links et al., 1999; Zweig-Frank & Paris, 2002).

Consistently, BPD individuals reported higher levels of aggressiveness and hostility in several of its dimensions, such as assault, indirect aggression, irritability, resentment, suspicious and guilt. These findings support previous research showing that individuals with BPD tend to be angrier, more irritable and more prone to engage in aggressive behaviours (Goodman & New, 2000; Joyce et al., 2003; McCloskey et al., 2009). Impulsive aggression in BPD is observed clinically in form of inappropriate and uncontrolled expressions of anger, either towards the self or directly towards others in form of verbal hostility and aggressive outbursts. Characteristics of hostility behaviour include suspiciousness, cynicism, resentfulness, jealousy, and bitterness (Ramírez & Andreu, 2006). On the other hand, aggression is typically a response to dysregulated anger and many of the

impulsive and aggressive behaviours displayed by BPD individuals are associated with emotional distress (APA, 2000). Affective instability is together with impulsivity considered to be a nuclear dimension of BPD (Lieb et al., 2004; Rosenthal, Cheavens, Lejuez, & Lynch, 2005; Stepp et al., 2014) and a prevalent and enduring aspect of the BPD diagnostic criteria (Skodol et al., 2005). Even though both dimensions are nuclear symptoms of BPD, which are undoubtedly related, doubts persist concerning their interrelations. It has been suggested that impulsivity in BPD could be facilitated by emotional dysregulation, and impulsive aggressive behaviour would primarily occur in the presence of significant negative emotionality affect (Carpenter & Trull, 2013). Similarly, it has been suggested that the associations between BPD symptoms and aggression could be mediated by difficulties in emotions regulation (Stepp et al., 2014). Within this context, emotional state may moderate behavioural dysregulation in BPD (Chapman, Leung, & Lynch, 2008) and impulsive aggression could be secondary to emotional dysregulation in BPD. In futures studies it would be interesting to investigate the influence of emotion dysregulation in the different components of impulsivity and aggressiveness in BPD.

Impulsivity has been previously linked to orbitofrontal cortex dysfunction (Berlin et al., 2005), and specifically medial and lateral regions dysfunction of orbitofrontal cortex could mediate symptoms of impulsivity in BPD (Wolf et al., 2012). Furthermore, results of twin and family studies have shown impulsivity and aggression to be partially heritable (Coccaro, Bergeman, & McClearn, 1993; Dougherty et al.,2003; Hines & Saudino, 2004; Tuvblad & Baker, 2011), and associated with underlying biological deficits including serotonergic dysregulation and functional impairment of frontal-limbic circuits (Haberstick, Smolen, & Hewitt, 2006; Manuck et al., 1999) that are also present in BPD (Donegan et al., 2003; New et al., 1998). In neuroimaging studies, both impulsivity and aggression have been associated with structural and functional abnormalities in brain networks involved in regulation of mood, impulsive and behaviour (Krause-Utz et al., 2014; Soloff et al., 2014). The consistency of our results in self-report measures sustain previous research indicating

that measures of aggression and impulsivity may serve as endophenotypes for BPD as both traits vary within the general population and are strongly associated with BPD (Amad et al., 2014; Bevilacqua & Goldman, 2013; McCloskey et al., 2009).

Regarding the results from the dimensional model of personality, BPD individuals exhibit significantly higher temperament dimensions of novelty seeking and harm avoidance, consistent with previous findings (Amianto et al., 2012; Barnow et al., 2006; Fassino et al., 2009; Joyce et al., 2003; Kaess et al., 2013; Pukrop, 2002), reflecting poor impulse control and high emotional sensitivity. This particular constellation of temperament traits may result in neurotic behaviour caused by a difficulty satisfying the simultaneous need for stimulation and the need for security and protection (Svrakic et al., 1993). According to the present results, the combination of these extreme traits could be an indicator of a biological predisposition towards a behavioural disturbance and to the highly conflictive behavioural patterns characteristic of borderline pathology. Our findings are in line with recent studies suggesting than poor impulse control and emotional sensitivity could indicate a precursor sign of BPD (Chanen & Kaess, 2012) or a reflection of a biological vulnerability for the development of BPD (Crowell et al., 2009). Moreover, are also consistent with studies reporting higher levels of these temperament traits in BPD patients compared with individuals with bipolar disorder (Nilsson, Jørgensen, Straarup, & Licht, 2010) and patients diagnosed with attention-deficit/hyperactivity disorder (van Dijk et al., 2012), providing further evidence to the view that this temperamental profile might be specifically associated with BPD when compared to other psychiatric disorders.

Regarding character dimensions, BPD patients exhibit low traits in character dimensions of self-directedness and cooperativeness, consistent with previous studies (Barnow et al., 2006; Joyce et al., 2003; Kaess et al., 2013; Pukrop, 2002; Richter & Brändström, 2009) and with Cloninger et al.'s (1993) postulations suggesting that lower self-directedness and cooperation profiles are a

common core characteristic of personality disorders. While self-directedness is related to individuals' self-acceptance and maturity, cooperation refers to the individual as an integral part of society involving acceptance of others and compassion (Cloninger et al., 1993). BPD patient's scores were extremely low in these two character dimensions, indicating a lack of self-awareness, chronically low self-esteem, lack of long-term goals and difficulties accepting responsibility, as well as a tendency to be more hostile and revengeful, which is consistent with general criteria to personality disorders. Recent research provide evidence suggesting that this particular temperament and character profile could occur early in the course of the disorder or predispose the individual to a higher risk for developing BPD (Kaess et al., 2013). The data of the present work validate the usefulness of dimensional models of personality to describe borderline pathology, supporting the idea of a conceptual redefinition of personality disorders from an understanding of the function of normal personality (Hengartner et al., 2014). Future studies should investigate if this temperamental profile represents a dysfunction in specific neurotransmitter systems as suggested by Cloninger's (1993). The identification of certain temperamental predispositions in early stages of development could also increase our understanding of the development of borderline pathology latter in life.

In contrast to self-reported measures, the results of the laboratorial behavioural task did not discriminated between BPD subjects and healthy controls, thus were not indicative of increased impulsivity nor suggested the presence of deficits in the inhibitory control in BPD individuals. Our results do not support previous data reporting deficits in response inhibition in BPD patients (Dell'Osso et al., 2010; Feliu-Soler, Soler, et al., 2013; Hochhausen et al., 2002; Krause-Utz et al., 2013; Rentrop et al., 2008; Rubio et al., 2007) but are in line with several previous studies that reported no deficits in rapid-response impulsivity in BPD individuals (Domes et al., 2006; Jacob et al., 2010; Lazzaretti et al., 2012; Lenzenweger et al., 2004; Sebastian et al., 2013; Stanford et al., 2009). This relative lack of evidence was also noted in a recent review that concluded that laboratory tests of impulsivity seem to render weak and inconsistent results (Sebastian et al., 2013).

Furthermore, we want to shed light on the relation between behavioural and trait impulsivity within the BPD group. Similar to Jacob and colleagues (2010) study, we found a discrepancy between self-report and behavioural data: BPD patients scored significantly higher on self-report measures as compared to healthy controls, but not in behavioural tests, and these two measures did not correlated with each other. This lack of association between measurements are also in line with other research (Domes et al., 2006; Hagenhoff et al., 2013; LeGris, Toplak, & Links, 2014; Rentrop et al., 2008; Sebastian et al., 2013) suggesting a lack of relationship between alterations in parameters of inhibitory functioning in experimental approaches and self-reported impulsiveness. Although few studies have investigated the relation between different data levels, this discrepancy between self-report and behavioural data is not limited to BPD samples and seems to be related to the complexity of the construct of impulsivity (Bari & Robbins, 2013; Evenden, 1999; Stanford et al., 2009), and possibly also to the use of heterogeneous methodologies. Congruent with this data, a recent study (Broos et al., 2012), using principal component analysis, found that impulsive action, impulsive choice and self-reported impulsivity loaded on three independent factors. Furthermore, the difficulty of measuring impulsivity by means of behavioural tests is also complicated because most cognitive tasks, including those explicit devised as a measure of behavioural inhibition, require the contribution of several factors other than impulse control, than can influence the performance (Bari & Robbins, 2013). Future research should aim to identity different inhibitory mechanisms that drive impulsive behaviour in order to explain the poor correlations among measures of impulsivity and inhibitory control. Even so, this lack of significant impairment is quite surprising in light of clinical evidence that individuals with BPD frequently engage in impulsive decision making. Although the behavioural measure of impulsivity used in the present study was selected on the basis of past research, it is possible that other tests would be more suitable to impulsivity assessment (Dougherty et al., 2005), such as those recreating the interpersonal and other contextual factors that would increase the negative affect associated with the task (McCloskey et al.,

2009). For example, Lawrence et al (2010) using other paradigms found that BPD individuals BPD could be characterized by a preference for immediate gratification and a tendency to discount longer-term rewards. Similarly, other studies have found that a negative emotional state may moderate performance in BPD (Chapman, Dixon-Gordon, Layden, & Walters, 2010; Chapman et al., 2008; Sprague & Verona, 2010). Current evidence suggests that "cold", i.e., emotionally neutral impulse control, is less affected in BPD than "hot" impulse control, i.e., components involving affective and/or motivational aspects (Sebastian et al., 2013). Understanding disinhibition in BPD seems to require further investigation on broader and more complex levels, covering situational and emotional factors as well. It would be interesting to include other behavioural measures such as decision-making and delay of gratification or affective decision-making (Dougherty et al., 2005; LeGris et al., 2014) in future studies, in order to study impulsive behaviour, as well as behavioural methods that aim to further understand the connection between emotions and impulsivity in BPD. On the other hand, new line of evidence suggests that although basic mechanisms of impulsive control may not be disturbed in BPD, the clinically observed impulsive behaviours could be related to comorbid conditions, such as attention-deficit hyperactivity disorder (Asherson et al., 2014; Ferrer et al., 2010). Future studies should also take into account the presence of comorbid conditions to BPD and include a clinical comparison group in BPD. Finally, the heterogeneity and complexity intrinsic to borderline pathology could also hinder the study of potential endophenotypes such as impulsivity, especially in terms of behavioural and neurocognitive domains. As previously mentioned impulsivity in not a unitary construct; analysing the different aspects of impulsive behaviour and relating these to specific neurobiological circuits would improve our knowledge about the etiology of complex behaviours for which impulsivity is a nuclear feature and advance genetic studies in this behavioural domain. The use of more comprehensive measures covering the different facets of impulsivity could also contribute to establish the existence of

differential neuropsychological profiles in BPD and to investigate the neurobiological underpinnings of such processes.

Within our sample, 70% of BPD individuals had a past history of suicide attempts, and among those a lifetime average of 3.5 attempts was reported, consistent with previous data from the literature (Soloff et al., 1994; Soloff et al., 2002; Zanarini et al., 2008). An increased number of attempts is one of the most consistent predictors and a strong risk factor for future suicide and completed attempts in BPD patients (Chesin et al., 2010; Kolla et al., 2008; Links et al., 2013; Soloff & Chiappetta, 2012a). The evidence from the existing literature suggests that approximately 1 in 10 individuals who attempt suicide will eventually die by suicide (Lim et al., 2012). Our data provide additional evidence to the assumption that BPD individuals are a high-risk population to present suicidal behaviours and complete suicide, representing a clinically relevant model for the study of suicidal behaviour (Soloff & Chiappetta, 2012b; Wedig et al., 2012). Given the high rate and potentially lethality of suicide attempts among BPD individuals, it is of extreme relevance to investigate which factors can increase the likelihood of attempting suicide in this population, in order to improve our methods of intervention and prevention.

Since the findings from the first study clearly validated the use of self-report instruments in BPD assessment and research, in the second study these measures were used to investigate the impact of personality traits in relation to suicidal behaviours in BPD. Our results indicate that hostility and aggressiveness seem to be closely related to suicidal behaviours in this disorder. Specifically, BPD individuals with previous suicide attempts were characterized by high levels of behavioural and attitudinal hostility, and also in three of its facets, resentment, suspiciousness and guilt. Hostility not only distinguished between BPD attempters from non attempters, but also proved to be a strong predictor of the presence and a higher number of previous suicidal attempts among BPD subjects, which is in line with previous studies reporting an association between aggression and suicide

attempts in individuals with BPD (Evren et al., 2011; Keilp et al., 2006; Mann et al., 1999; Oquendo & Mann, 2000; Soloff et al., 2000). Hostility is associated with the impulsive–aggression dimension and encompasses an emotional component, as it incorporates emotions such as anger or resentment in its definition. Impulsive–aggression is an endophenotype that increases the likelihood of aggressive behaviour given environmental triggers (McCloskey et al., 2009). According to Oquendo and Mann (2000), impulsive aggression may emerge in response to deprivation or punishment and is accompanied by frustration, irritability, fear or anger. Anger may or may not lead to aggression; in the case of BPD, aggression is usually directed to the self, and recurrent suicidal behaviours seen in patients with BPD are frequently associated with intense anger or with subjective feelings of deception or frustration. Self-aggressive behaviours observed in BPD appear to be related with highly emotional states, such as anger and hostility, which is also supported by the present results. Additionally, we found that higher hostility was also predictive of the severity of suicide in BPD subjects. These results are also suggestive of data from more recent studies reporting an association between aggression construct and higher lethality suicidal attempts (Chesin et al., 2010; Soloff et al., 2014).

In contrast, and contrarily to what we expected impulsiveness, defined as a stable trait of personality, and temperament dimensions of novelty seeking and harm avoidance did not seem relevant to suicidal behaviour in BPD patients. Although several previous studies have linked impulsivity (Brodsky et al., 1997; Chesin et al., 2010; Horesh et al., 1997; Mann et al., 1999; Yen et al., 2009), and temperamental traits (Calati et al., 2008; Conrad et al., 2009; Joyce et al., 2010; Perroud et al., 2013) with suicidal behaviours in BPD other have failed to find significant associations (Soloff et al., 2005, 2008; Soloff & Fabio, 2008; Wedig et al., 2012). These contradictory results as well as the lack of relationships found in our study could be related to the heterogeneity of the construct of impulsivity and the lack of attention to the complex and multifaceted nature of the construct. Some of these previous studies reporting impulsivity as a

significant predictor of suicide attempts in BPD measured impulsivity as a BPD criterion (i.e., assessing the presence of impulsive behaviour, such as substance abuse and self-harm). Instead, we used an instrument that assesses global impulsivity comprised of three factors: motor, cognitive and non-planning impulsiveness (Patton et al., 1995). Differences in the impulsivity construct measures could also explain these results.

Although both impulsivity and aggression have been widely linked to suicidal behaviours, some have speculated that aggression has a stronger association with suicidal behaviours than impulsivity (Brent, 2009; Melhem et al., 2007; Perroud et al., 2011), which is also supported by the present results. On the other hand, it has been suggested that impulsive aspects of the aggression construct support the observed relationships between aggression and suicidality. Within this view, impulsive aggression but not other aspects of aggression would be more strongly associated with suicidal behaviour. Disinhibition may predispose individuals to suicidal behaviour when it occurs together with high levels of hostility-aggression (Gvion & Apter, 2011). As previously mentioned, impulsivity and aggressiveness are related trait dispositions, but not identical constructs. On the other hand, dissimilarities may be explained by the confusion between the state and trait dimensions of the impulsivity-suicide relationship, that is, between the impulsivity of the suicidal act and impulsivity as an individual personality trait (Baca-Garcia et al., 2005; Gvion et al., 2014).

Moreover, it has also been suggested that impulsivity could indirectly contribute to suicidal behaviours, and aggression would act as a mediator. High lethality attempters share many clinical characteristics with patients who complete suicide (Black et al., 2004; Kolla et al., 2008; Links et al., 2013) and may share neurobiological vulnerabilities related to high-risk personality traits such as impulsivity and aggression (Gvion & Apter, 2011). Within this view, Chesin et al. (2010) suggested that impulsivity is significantly related to frequency of attempts and may play an indirect role in high lethality attempts and completion. However, others have failed to find this predictive

association (Soloff et al., 2005; Soloff & Fabio, 2008) and more prospective studies are needed. In addition, recently Soloff and colleagues (Soloff, Chiappetta, Mason, Becker, & Price, 2014) provided further evidence of the neural substrates of impulsivity and aggression in the context of suicidality in BPD. These authors found specific neural substrates that may functionally mediate these personality traits, and that lethality of suicidal behaviour in BPD may be determined, in part, by the mediation of impulsivity and aggression by specific neural networks involved in the regulation of mood, impulse and behaviour. Ultimately, from clinical experience and much of the research there is intuitively an important role for impulsivity and aggression in the understanding of suicide but further research in needed and a clearer conceptual refinement in this area is imperative.

The other key factor for suicidal behaviour in the present study was having suffered childhood sexual abuse. Among our BPD sample, almost 30% reported having suffered sexual abuse during childhood, a high percentage although higher percentages have been described in the literature (Zanarini et al., 2010). BPD patients with history of childhood sexual abuse had greater lifetime number of attempts, in particular 2.2 more lifetime attempts than non-abused patients. Moreover, the presence of childhood sexual abuse increased 10-times the risk of having a suicide attempt in patients with BPD, and an increased number and severity of attempts. These results support previous research demonstrating a prominent role of childhood sexual abuse to suicidal behaviour among individuals with BPD. In this sense, previous works had reported that adverse experiences in childhood (Brodsky et al., 1997; Zanarini et al., 2002), and especially childhood sexual abuse (Chen et al., 2010; Soloff et al., 2000; Soloff et al., 2002; Trask et al., 2011), are an important risk factor for suicidality in BPD and a possible aetiological factor in the development of self-destructive behaviours such as suicidal behaviours (Bandelow et al., 2005; Bandelow, Gutermann, Peter, & Wedekind, 2013). Experiencing sexual abuse can create a feeling of powerlessness in the child that leads to the perception of having little control over what happens (Dube et al., 2005). Consequently, this lack of sense of control could act as a stressor that could have an effect on a

neurodevelopmental level (Hornor, 2010). A recent theory, the interpersonal–psychological theory of suicidal behaviour (Joiner et al., 2009; Ribeiro & Joiner, 2009; Van Orden et al., 2010), explains suicidal behaviour in BPD based on the presence of two interpersonal constructs, perceived burdensomeness and thwarted belongingness, and a third component, which is the acquired capacity for suicide. This third component could emerge from a repeated exposure to physically painful and/or fear-inducing experiences. In light of this theory, personality variables (such as impulsivity and aggression) and childhood abuse would be contributing factors to the development of the capacity for engaging in suicidal behaviours (Bender, Gordon, Bresin, & Joiner, 2011; Joiner et al., 2009). The presence or absence of a childhood abuse history, and especially childhood sexual abuse, should be determined when considering the risk of recurrent suicidal behaviour. Patients with BPD internalise the characteristics of an invalidating environment and tend to show self-invalidation (Crowell et al., 2009). Within this model, childhood sexual abuse represents a particularly extreme form of invalidation, and the pattern of self-mutilation and suicide attempts may develop as a mean of coping with the intense and painful feeling experienced by these patients. Consistently, our results showed that having suffered childhood sexual abuse along with increased hostility in BPD individuals entails an increased risk for suicidal behaviours in BPD. In the stress-diathesis model of suicide proposed by Mann (1999), trait dispositions such as impulsivity and aggressiveness may be heritable (e.g., as endophenotypes), or acquired in the course of development (e.g., through childhood abuse). Related to this, some authors postulate that childhood abuse can influence certain aspects of personality development, including the distortion of the sense of identity, self-regulation and interpersonal relationships (Braquehais et al., 2010; Kuritárné, 2005; McCrory et al., 2012). Within this line of view, a recent review concluded that a history of childhood maltreatment is a predictor of aggression in BPD (Allen & Links, 2012). Similarly, Evren et al. (2013) suggested that aggression (particularly hostility) and impulsivity may be mediators of the association between childhood trauma and dissociation. Alternatively, aggressive or hostile

behaviours could also be a consequence of the traumatic experience related to the high levels of emotional distress stemming from the abuse (Nalavany, Ryan, & Hinterlong, 2009). Paris (2005) suggested that impulsive and suicidal patterns observed in BPD emerge from complex interactions between temperament vulnerability and life experiences. Similarly, Soloff et al. (2008) suggested a theoretical model that considers both temperament and childhood adversity as risk factors for suicidal behaviour in BPD and postulated that the relationships between both would be bidirectional throughout development. Adverse childhood experiences, especially childhood sexual abuse, could interact with existing temperament (impulsivity and aggression) (Braquehais et al., 2010; Evren et al., 2013), leading to persistent psychobiological abnormalities which impair adaptive responses to stress (Ladd et al., 2000). Both temperamental and childhood abuses have been suggested to be involved in the severity of BPD (Hengartner et al., 2013; Joyce et al., 2003; Kaess et al., 2013; Lobbestael et al., 2010; Martín-Blanco et al., 2014; Zanarini & Frankenburg, 1997). The exact nature of the relationship between childhood sexual abuse, personality traits and suicidal behaviours seems to be complex and further complicated as BPD diagnosis represents itself a strong and consistent predictor of both suicidal behaviours and complete suicide (Beautrais, 2000). Interaction between diathesis and stressors may provide the best model for understanding how impulsivity and suicidal behaviours pattern associated with BPD can develop (Braquehais et al., 2010; Paris, 2005b). In this model, the impulsive and suicidal patterns seen in BPD would be conceptualized as a final common pathway, emerging from complex interactions between temperamental vulnerability and life experiences.

More recently, new lines of evidence from brain imaging studies suggested that volumetric and functional changes associated with BPD (O'Neill & Frodl, 2012; Ruocco, Amirthavasagam, & Zakzanis, 2012) could be associated with exposure to physical and sexual abuse during childhood (Brambilla et al., 2004; Soloff, Nutche, Goradia, & Diwadkar, 2008). Furthermore, another recent study (Morandotti et al., 2013) found that this volume reduction in specific brain regions was

associated with higher levels of aggressiveness as measured by the BDHI in BPD patients with a history of childhood abuse. The authors suggested that these brain structural alterations could increase the vulnerability to irritability states and aggressive reactions in childhood abused BPD patients. Although in our study we focused on the impact of childhood sexual abuse, in future research it would be interesting to study the impact of other forms of abuse or maltreatment. More research is required to understand how duration, frequency and type of abuse might play a role in suicidal behaviours in BPD. Furthermore, it is imperative to encourage a better identification of those that might be at risk as well as the development of more effective interventions to prevent childhood abuse. Related to this matter, it would have been interesting to take into account other related disorders, such as dissociative disorders and dissociation, as some studies suggest an association between dissociative disorders and suicidality (Foote, Smolin, Neft, & Lipschitz, 2008; Ross, Ferrell, & Schroeder, 2014), as well as between dissociative disorders, BPD and childhood trauma (Sar, Akyuz, Kugu, Ozturk, & Ertem-Vehid, 2006; Vermetten & Spiegel, 2014). Nevertheless, a strength of the present work is that it explores the joint effect of two major risk factors of suicide in BPD, personality traits and childhood sexual abuse, as well as the use of different impulsivity-related measures of trait personality, which were previously recommended to assess this nuclear feature of BPD. Future studies should confirm our findings as well as identify other biological and environmental risk factors associated with suicide in BPD.

Knowledge of clinical risk factors for suicide in BPD is probably the most important tool for mental health professionals to help prevent suicide. The present findings highlight the importance of discriminating which of the impulsivity-related traits is associated with the severe behavioural disturbance in BPD, in order to establish more effective guidelines for its treatment and prevention. Impulsive and aggressive traits may be considered distal precursors of suicidal behaviour, developmentally shaped by the interaction of environmental adverse events (childhood trauma) and genetic factors. They are, however, relatively heterogeneous constructs underlying complex

cognitive and behavioural dispositions, whose diverse components deserve further investigation for their possible implications in suicidal behaviours in BPD and other psychiatric conditions (Perroud et al., 2011). The management of aggressiveness and hostility can be especially important to prevent recurrent self-aggressive behaviour in patients with BPD. Anger management is, in fact, an important aspect addressed in dialectical behavioural therapy (Linehan, 1993). DBT combines standard cognitive–behavioural techniques for emotion regulation with concepts of distress tolerance, acceptance and mindful awareness. As Linehan et al. (2006) suggested, an emphasis should be placed on helping the patient to learn to tolerate and respond to negative affects without behaving aggressively. Mindfulness training seems to have a positive effect on attention and impulsivity variables in patients with BPD (Soler et al., 2012). In this sense, mindfulness skills, interpersonal effectiveness, emotion regulation and distress tolerance can be effective in helping patients to incorporate the necessary skills to manage and tolerate anger and aggressiveness, without acting in an aggressive and/or self-aggressive manner, such as suicidal behaviour.

To conclude, the findings of the present work, support the evidence of the central role of impulsivity in BPD, and support previous research demonstrating that when assessed by self-report measures, BPD patients display elevated levels of trait impulsiveness, on several aspects of this construct, as well as high levels of hostility and aggressiveness. Furthermore, impulsivity and aggressiveness demonstrate a distinct pattern of association with the suicidal behaviours in BPD. Hostility, but neither impulsiveness nor temperament traits, relates to suicidal behaviours in BPD. Together with increased hostility, the presence of childhood sexual abuse increases 10-times the probability of the occurrence of suicide attempts later in life, and also independently of overall disorder severity. Overall, these findings highlights the importance of characterizing and assess impulsivity taking into account its multifaceted and complex nature. It is necessary to conceptualize and to separate impulsivity from the construct of aggression and impulsive aggression, since although related they are different concepts with different roles in borderline pathology. The present

results endorse further evidence of the usefulness of self-report instruments in BPD clinical assessment and research, and argue in favour of trait dimensional perspective in BPD study in order to provide a more comprehensive internal understanding of the disorder. Finally, our data provide support to a growing understanding that hostile-aggressive BPD individuals and early traumatic events such as childhood sexual abuse may be a predisposition to a high risk factor combination of suicide in BPD.

6. CONCLUSIONS

6 CONCLUSIONS

The empirical work of the present thesis allowed the conclusion of a set of inferences, which are outlined below:

1. BPD patients are characterized by increased levels of trait impulsiveness, specifically greater motor activation, less attention and decreased planning.

2. High levels of aggressiveness measured as a component of attitudinal and behavioural hostility characterize BPD individuals.

3. BPD individuals do not show an increased behavioural impulsivity nor exhibited deficits in response inhibition when assessed with the *Continuous Performance Test* (CPT-IP).

4. Self-report measures of impulsivity do not correlate with behavioural impulsivity measured by a laboratorial task.

5. Cloninger's psychobiological dimensional model is a useful model to describe the dimensional personality profile of BPD patients, which is characterized by high temperament traits of novelty seeking and harm avoidance, and low traits of self-directedness and cooperation character dimensions.

6. BPD individuals with previous history of suicide attempts display higher levels of behavioural and attitudinal hostility, and report higher prevalence of childhood sexual abuse compared with BPD patients with no previous history of attempts.

7. Being particularly more hostile and having suffered sexual abuse during childhood entails an increased risk of suicidal behaviour in BPD individuals.

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