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# Association between morningness/eveningness, addiction severity and psychiatric disorders among individuals with addictions

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## ABSTRACT

Studies have shown that Evening-Type (ET) subjects used more stimulating and sedative substances, and presented more psychiatric disorders than Morning-Type (MT) subject. However, there is a lack of data on the chronotype of patients with addiction. The aim of our study was to describe chronotype and associated factors in a sample of outpatients beginning treatment for addiction. Subjects were assessed with the Morningness–Eveningness questionnaire of Hörne & Ostberg, the Addiction Severity Index and the Mini International Neuropsychiatric Interview. In the 333 subjects with an addiction, 20% were MT and 32% were ET. When comparing ET to MT, multivariate analysis showed that ET was significantly associated with poly-problematic addiction, non-substance addictions, cannabis addiction, and mood disorders, but not with severity of addiction. MT was associated with antisocial personality disorder. Results suggested that chronotype was associated with specific addiction pattern and psychiatric disorders.

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## 1. Introduction

Chronotype or Morningness–Eveningness preference of humans is an intrinsic biological characteristic defined by the sleep–wake cycle and the variation of the attention level between morning and evening. Time preference for other activities like sports, cultural activities or work schedules, is also taken into account for assessment of chronotype. Chronotype is a “continuum” of which the two extremes are morning and evening subjects (Natale and Cicogna, 2002). Subjects who wake up and go to bed early are called Morning-Type (MT). The period during which their physical and cognitive functions are optimum appears earlier than in the Evening-Type subjects (ET) who wake up and go to bed late. The subjects between these two extremes are classified as Intermediate-Type (IT) (Home and Ostberg, 1976; Adan, 1994; Taillard et al., 1999; Giannotti et al., 2002). Circadian typology is determined using several self-questionnaires that have

been validated in adults in several countries, such as the Munich ChronoType Questionnaire (MCTQ) and the Morningness–Eveningness Questionnaire (Di Milia et al., 2013).

The interest of studying circadian typology has been demonstrated in humans as it can affect biological and psychological functioning, and be implicated in some disorders (Adan et al., 2012). Several individual factors have been shown to be associated with the different chronotypes, such as sex, age, life choices and personality dimensions (Adan et al., 2012). For example, cross-sectional studies showed that MT is the most frequent during childhood (Randler and Truc, 2014), then ET is the most frequent until 19 years-old for girls and 21 years-old for boys (Taillard et al., 1999; Giannotti et al., 2002). Ageing people gravitate towards the MT (Roenneberg et al., 2007; Taillard, 2009). A longitudinal study also found that MT was the most persistent chronotype with ageing and that a majority of ET change for another type with ageing (Broms et al., 2014). Furthermore, there is evidence for the association between circadian rhythmicity and psychiatric disorders, particularly with mood disorders (Chelminski et al., 1999; Kasof, 2001; Giglio et al., 2010; Reid et al., 2012) supporting the hypothesis that chronotype could be a risk factor linked to

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environmental aspects and genetic vulnerability (Adan et al., 2012). ET also presented lower psychological well-being than other chronotypes (Wittmann et al., 2010). Interestingly, previous studies found that ET subjects were more frequently smokers and drank more caffeine and alcohol than subjects with other chronotypes (Adan, 1994; Taillard et al., 1999; Giannotti et al., 2002; Wittmann et al., 2010), and that ET subjects used more illegal substances (cannabis, cocaine, ecstasy) than MT (Prat and Adan, 2011). Other studies have shown that ET is associated with eating behavior (unfavorable dietary habits, eating disorders, obesity) or other behaviors like compulsive internet use (Kasof, 2001; Natale et al., 2008; Kanerva et al., 2012; Lin and Gau, 2013; Lucassen et al., 2013; Konttinen et al., 2014). All these studies suggest a link between circadian typology and substance use and support the hypothesis that ET could be a risk factor for higher consumption for both legal and illegal substances and behaviors that could lead to loss of control of use and addiction (Auriacombe, 1997). It has been suggested that the use of substances may help ET subjects to adapt themselves to the “social jetlag” (Taillard et al., 1999; Roenneberg et al., 2007) they experience in order to adjust their degree of daytime arousal to the environmental contexts. Stimulant use might help to cope with the daytime sleepiness, while sedative use may help to relax and find sleep earlier (Adan, 1994; Wittmann et al., 2006, 2010). In this perspective, evening typology may represent an individual difference that should be taken into account as a risk factor for the development of addiction. Moreover, it has been shown that some circadian clock genes (e.g. PER1, PER2, PER3 and CLOCK genes), which regulate many bodily functions including sleep/wake activity, cognition and attention, are regulators of the dopaminergic activity in the brain reward areas and are involved in the vulnerability for addiction (McClung, 2007; Rosenwasser, 2010; Adan et al., 2012). Another study showed an association between ET, the activity of reward system (mPFC and ventral striatum), alcohol use and addiction among late adolescents (Hasler et al., 2013). Another hypothesis is that the association between substance use and ET could be better explained by the psychiatric disorders that are highly prevalent among ET subjects and have also been identified as a major risk factor for addictive disorders (Grant et al., 2004; Compton et al., 2007; Hasin et al., 2007).

These factors suggest a possible link between chronotype and addiction for a large range of substances or behaviors. However, until now, no study has attempted to examine chronotypes among use disorder subjects, type of substance or behavior and addiction severity.

The aims of this study were (1) to describe chronotypes in a sample of subjects with at least one substance or non-substance (mainly gambling and eating disorders) addiction, and (2) to compare socio-demographic characteristics, addiction severity and psychiatric comorbidities according to chronotype.

## 2. Methods

### 2.1. Subjects

Participants were enrolled as consecutive patients in outpatient addiction clinics in Bordeaux and Bayonne, Aquitaine, France, from June 2011 to August 2013. Patients were eligible for inclusion if they met DSM-IV substance dependence criteria for any substance or for non-substance addiction (pathological gambling, eating disorders), were seeking treatment for their addiction, and were over 18 years of age. The exclusion criteria were to have difficulties understanding written and spoken French language, to present a visual disability incompatible with the study (self-questionnaire) and the presence of current psychotic disorders (DSM-IV) preventing from having reliable answers to questionnaires. The study was approved by the Institutional Review Board of the University of Bordeaux (France). All the participants gave their informed written consent to participate after full explanation of the procedure.

### 2.2. Assessments

#### 2.2.1. The Morningness–Eveningness Questionnaire (MEQ)

The Morningness–Eveningness Questionnaire is a 19 questions self-questionnaire exploring life preference in terms of hours for activity, sleep/wake cycle, meals, and tiredness and sleepiness at some point of the day. Score ranges from 16 to 86, with higher scores indicating greater morningness tendencies (Morning Type or MT) and lower scores indicating greater eveningness tendencies (Evening Type or ET). Previous studies have shown that chronotype is significantly associated with age (Taillard et al., 1999; Roenneberg et al., 2007). Thus, scores can be divided into three categories according to age (Horne and Ostberg, 1976; Taillard et al., 2004):

- Morning Type: scores  $\geq 59$  for subjects  $< 45$  years old, and scores  $\geq 65$  for subjects  $\geq 45$  years old.
- Evening Type: scores  $\leq 41$  for subjects  $< 45$  years old, and  $\leq 52$  for subjects  $\geq 45$  years old.
- Intermediate Type:  $41 < \text{scores} < 59$  for subjects  $< 45$  years old, and  $52 < \text{scores} < 65$  for the subjects  $\geq 45$  years old.

#### 2.2.2. The Mini International Neuropsychiatric Interview (M.I.N.I.)

The M.I.N.I. is a structured diagnostic interview to explore the criteria for the 17 main DSM-IV Axis-I psychiatric disorders including substance dependence and pathologic gambling, as well as Axis-II antisocial personality disorder. This tool has shown a good validity, sensitivity and specificity (Sheehan et al., 1998).

#### 2.2.3. Addiction Severity Index (ASI)

The ASI is a semi-structured interview used in both research and clinical settings to gather information in different areas of the life of an individual. For each explored status (medical, employment/support, drug/alcohol, tobacco, pathological gambling and other non-substance addictions, legal, family/social relationships, psychological), a severity score is established by the interviewer. The Interviewer Severity Rating (ISR) ranges from zero to nine and reflects the severity of the current status of the patient in the considered area (McLellan et al., 1992, 2006). We used a modified and validated French version of the ASI which includes non-substance addictions (Denis et al., 2012, 2015).

### 2.3. Procedure

Upon enrollment in treatment, all eligible patients were proposed participation in the study. After written informed consent was obtained, individuals who accepted received a one-hour clinical interview to assess chronotype (MEQ), addiction severity (ASI), and psychiatric co-morbidities (MINI).

### 2.4. Statistical Analysis

#### 2.4.1. Variables

The dependent variable was chronotype, measured with the MEQ. Morningness–Eveningness Questionnaire survey provides a raw score which can be divided into three categories by age (MT, IT and ET). I-type subjects are described in the literature as subjects with less pronounced or neutral chronotype (Horne and Ostberg, 1976). We decided to exclude them from the analyses and compare only extreme chronotype (MT and ET).

The independent variables included demographic information from the ASI: age, gender and past month activities. Age was recoded into two categories: 18–44 years old; 45 years old and older. Subjects were considered to have worked in the last 30 days if they worked one day or more. Addiction-related information from the ASI included: the main problematic addiction (alcohol, other substances, tobacco, or non-substance addiction) reported by the subject, Interviewer's Severity Ratings (ISR) for the main problematic addiction, number of previous treatments for addiction, and mean lifetime duration of substance use/addictive behavior. Patients who reported more than one substance or behavior as the main problem were considered as “poly-problematic” users. The ISR of the psychological status, employment and family-social relationships were also taken into account. The diagnosis of a poly-dependence was also obtained with the MINI and was defined by the presence of at least two current dependences according to DSM-IV criteria. As tobacco addiction is very common among subjects treated for other substance addictions, we decided to exclude tobacco addiction in the calculation of number of diagnosis for “poly-dependent”. Data related to psychiatric comorbidities from the MINI included: current mood disorders (including Major Depressive Disorder, Manic and HypoManic episodes), current anxiety disorders (including Panic Disorder, Social Phobia, Agoraphobia, Obsessive Compulsive Disorder, Generalized Anxiety Disorder and Post-Traumatic Stress Disorder), current psychotic disorders, antisocial personality disorder, adult attention deficit disorder/hyperactivity disorder (ADHD).

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