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Highlights

- This study examines the relationship between temperament and personality and the nomophobic using Questionnaire to Assess Nomophobia (QANP; Rueda et al., 2017) and Temperament and Character Inventory Revised (TCI-R; Cloninger et al., 1993).
- Cooperation is a characteristic that significantly reduces Nomophobic levels.
- Reward Dependence is positively related to Nomophobia.

ACCEPTED MANUSCRIPT

Temperament and characteristics related to nomophobia

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Abstract

Nomophobia is defined as the fear of being out of mobile phone contact and is considered to be a phobia of the modern age. The current study set out to establish the relationship between temperament and personality and the development of nomophobia. The sample was composed of 968 participants selected from the Andalusian population, of which there were 182 males and 785 females aged from 23.19 years. The instruments used were the Questionnaire to Assess Nomophobia (QANIP; Olivencia-Carrón et al., 2018) and the Temperament and Character Inventory Revised (TCI-R; Cloninger et al., 1993). We found that cooperation is a characteristic that significantly reduces Nomophobic levels, particularly for the two factors of Mobile Phone Addiction and Negative Consequences. Furthermore, Reward Dependence appears to be positively related to two of the factors involved in nomophobia, namely Mobile Phone Addiction and Loss of Control, suggesting a relationship between Nomophobia and personality. These findings are discussed in terms of their usefulness for identifying the personality predictors of nomophobia in order to develop preventive and intervention strategies.

Keywords: Nomophobia, Temperament, Character, Cooperation, Reward Dependence

1. Introduction

Nomophobia is considered to be a disorder of the modern world, derived from the technological developments and advances that have been produced by virtual communication. It is defined as the fear of being out of mobile phone contact and is considered a modern age phobia that has been introduced to our lives as a product of the interaction between people and mobile information and communication technologies (Nagpal and Kaur, 2016). Although Nomophobia has been regarded as a controversial term, it is referred to as dependence on mobile phones (Dixit et al., 2010) or an addiction to mobile phones (Forgays et al., 2014). Wang et al. (2014) defined it as the feelings of discomfort, anxiety, nervousness or distress that result from being out of contact with a mobile phone, even causing suicidal ideation as well as attempts. King, et al. (2014) revised the definition of nomophobia in order to increase its modern day relevance as a fear of being unable to communicate through a MP. Nomophobia is a term that refers to a collection of behaviours or symptoms related to MP use. Therefore, in the case of nomophobia, people with nomophobia or nomophobes would have an irrational fear of being out of mobile phone contact or being unable to use it, and thus they attempt to eliminate the chances of not being able to use their mobile phone. In the case of being unable to use their mobile phone, they experience intense feelings of anxiety and distress (Szyjkowska et al., 2014; Thomée et al., 2011). In this regard, it remains unclear as to how much distress and impairment can be caused by Nomophobia or the personality variables that are involved, and thus there is uncertainty with regard to which dimensions merit inclusion in personality classification. It is therefore necessary to determine whether harmfulness is

likely to occur as a consequence of the personality traits inherent in nomophobic individuals.

Numerous studies have explored how personality traits contribute to the onset and maintenance of addiction disorders in young adults, with high impulsivity and low self-control scores being key factors in addiction (Lee et al., 2012; Reynolds et al. 2006). Earlier studies have found that self-control is negatively correlated with the use of tobacco, alcohol, and cannabis, along with problematic gambling and computer gaming. Depression and extraversion have also been shown to be specific to substance users (Walther et al., 2012).

Mobile phone abuse is related to both extraversion (Bianchi and Phillips, 2005) and neuroticism (Kuss et al., 2014) although anxiety levels and the frequency of neurotic personality traits increase the severity of the addiction (Mok et al., 2014). Recently, high impulsivity has been identified as one of the risk factors for addiction to social networking sites among individuals who suffer from mobile phone abuse (Kim et al., 2016; Wu et al., 2013).

Cloninger's personality model (Cloninger et al., 1993) is a four-dimensional structure comprised of the temperament dimensions referred to as Novelty-Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (P) along with three additional character dimensions. These character dimensions are Self-Directedness (SD), Cooperativeness (C) and Self-Transcendence (ST). NS is the tendency to approach novel situations for rewards, and to experience relief from non-punishment. High NS includes impulsivity, quick temper, and proneness to breaking rules. HA is the tendency to inhibit or avoid responses to aversive cues, such as punishment and non-

reward. RD is the tendency to maintain responses that have been previously conditioned through rewards. High RD is associated with being sociable and sensitive to social cues. P is the tendency to maintain responses, despite frustration and fatigue. High P is associated with persevering and being ambitious. SD reflects the ability to control, regulate, and adapt one's behaviour to a situation in order to achieve one's goals and values. C reflects identification with, and acceptance of, others. Finally, ST is thought to reflect imaginativeness and spirituality. Cloninger's Psychobiological Model provides a better fit for the purpose of our goals, for three reasons. First, the Temperament and Character Inventory (TCI-R; Cloninger et al., 1993) predicts certain functional and clinical outcomes (Arnau et al., 2008). Second, the model was specifically developed for the purpose of analysing addiction (Gat-Lazer et al., 2017; López-Torrecillas et al., 2014a,b; Pedrero-Pérez and Ruiz-Sánchez de León, 2013; Pombo et al., 2017; Vitoratou et al., 2017). Third, research has demonstrated that personality character profiles predict life satisfaction. For instance, Park et al. (2015) examined the relationship between life satisfaction and personality traits and found that the ST profile was associated with the highest levels of life satisfaction, whereas the depressive profile was associated with the lowest levels of life satisfaction. Additionally, high SD, ST, and C were associated with high life satisfaction. The SD was the strongest in the assessment of one's quality of life, followed by ST and C. Similarly, Gutiérrez et al. (2016) indicated that temperament and character affect mental health, and in general, P stood out as the most important dimension regarding career success. SD was the best predictor of social functioning and HA was linked with clinical problems.

There has been a substantial body of research on the role of dispositional constructs (NS, HA, RD, P, SD, C and ST) in the risk of substance abuse (Lu et al., 2014; Gutierrez et al., 2016). Studies of Internet addiction have found decreased RD and increased NS among Internet-addicted participants (Ko et al., 2010) with the latter obtaining higher scores for TCI-R in NS, HA, P and ST; whilst lower scores in C also tended to predict the presence of behavioural addiction (Farré et al., 2015). In a similar survey, Kuss et al., (2014) identified increased neuroticism and low agreeableness as risk factors for Internet addiction.

However, relatively few studies have examined personality traits with regard to problematic and addictive abuse or nomophobia. Problematic mobile phone abuse is related to extraversion and neuroticism (Olivencia-Carrión et al., 2016; Takao, 2014), although anxiety levels and frequency of neurotic personality traits increase the severity of such an addiction (Mok et al., 2014). With regard to nomophobia, King et al. (2014) investigated the appearance of emotional alterations related to mobile phone abuse and found that nomophobes showed significant increases in anxiety, tachycardia, respiratory alterations, trembling, perspiration, panic, fear and depression when they were apart from or unable to use a mobile phone in comparison with healthy volunteers. However, the relationship between nomophobia and other psychological characteristics has received relatively little attention, and it may be particularly important to examine the predictors of nomophobia. Accordingly, Nagpal and Kaur (2016) studied the gender differences in nomophobia and impulsiveness in college students between the ages of 18 and 23 years and found that there were gender differences in nomophobia with male students

exhibiting higher levels of nomophobia in comparison with their female counterparts. However, no gender differences were found in impulsiveness or any of its components.

1.1. *Aims and hypothesis*

The current study is an attempt to understand the modern age mobile phone addiction known as nomophobia and its relationship with temperament and personality in the adult population of the Spanish autonomous community of Andalusia.

We take as our starting point the hypothesis that there are personality variables (temperament and character) that protect against the appearance of Nomophobia. The temperament variables would be reflected in low scores in the Search for Novelty, Avoidance of Harm, Dependence on Reward, and Persistence, whilst the character variables would be represented by high scores on Self-directedness, Cooperation and Self-transcendence and vice versa for the risk of the development of nomophobia.

2. **Methods**

2.1. *Data collection*

A sample of 968 respondents from the city of Granada (Spain) was employed in this experiment. The sample size was calculated according to the sampling design used, based on a sampling error of +5 percentage points and a confidence level of 95%. Participants were mainly recruited at their workplace, via recruitment stands, advertisements, and emails. Their managers/teachers were sent e-mails in which they were asked to help recruit their

employees/students. It was their managers/teachers who provided us with details of those employees/students willing to participate in the study. They were recruited from a range of types of workplace within Granada, including local authorities, healthcare providers, and retail outlets as well as institutions of higher and further education, and there was heterogeneity in their geographical settings, which spanned city center and urban fringe locations. Participants were informed about the aims of the study and provided signed informed consent. Ethical approval was obtained from the Research Ethics Committee from the University of Granada, Spain.

The participants had an average age of 23.19 years (SD 7.23), ranging between 17 and 55 years old, and the majority (81.1%) being women. Sociodemographic variables revealed that the majority of the sample was unemployed (81.3%), which is most likely to be a consequence of the large proportion of students in the sample (78.9%). Of the respondents who were employed (18.7%), 46.4% were working in manual jobs, 33.7% in the services and army sector, and 17.7% in the technological and business sectors. The average number of years of education for the respondents was 14.07 years (SD 4.12).

2.2. *Data preprocessing*

An initial search was conducted for missing values, but only one was found across all the predictor variables (the seven dimensions of the TCI-R) and thus no action was taken. The individual that presented the missing value was later excluded from the analysis, as this happened to be an outlier. Skewness statistics were calculated for all variables (predictor and predicted) to detect variables with high levels of asymmetry, in order to transform these according to

the nature of the skewness and its severity. Square-root and log transformations were used (Tabachnick and Fidell, 2000). Negative skewed variables were reflected before the transformations, and after completion of the skewness correction they were reflected again to recover their original value (Osborne, 2005).

Tukey's (1997) criterion for finding outliers using the interquartile range was used to find extreme univariate outliers, which resulted in the exclusion of 3 individuals. In the case of multivariate outliers, Mahalanobis distance was used, given that it approximately follows a Chi-Square distribution (Afifi and Azen, 1972), although Sidak (1967) correction had to be used due to the multiple comparisons that take place in the hypothesis test. Thus, with a final value of 0.00014 for alpha, 5 individuals were excluded using this process.

Pearson's correlation coefficient matrix was calculated for the multi-collinearity check in predictor variables. Every pair of correlations was below the selection criteria of 0.99 (Tabachnick and Fidell, 2000), meaning that there is no multi-collinearity in predictor variables.

2.3. *Weight adjustment*

The recruitment of respondents was not probabilistic and could lead to biased estimates since certain groups are substantially under-represented. Moreover, the sampling frame does not cover the entire population to which survey results are to be extrapolated. These errors can be overcome by the use of reweighting or calibration techniques. Calibration was defined in Särndal (2007) as "the determining of weights or expansion factors, incorporating auxiliary information to calculate adjusting factors to the weights originally defined in the sample design, the use of these weights to calculate population totals and other

parameters in finite population, and the seizing of the calibration adjustments to reduce significantly the bias contribution in the presence of non-response and other non-sampling errors". The usage of calibration estimators ensures that survey estimates are coherent with those already in the public domain, while simultaneously reducing sampling error and non-coverage (see Cabrera-León et al., 2015, 2017).

For the calibration conducted in this article, population totals of gender, age, and years of schooling were used as auxiliary variable totals. These quantities were retrieved from the 2013 population figures provided by the Spanish National Institute of Statistics (INE), in the case of gender and age, and from the 2011 Population and Households Census (also conducted by the INE) in the case of years of schooling. The retrieval was made for the region of Andalusia. Given that the sampling frame was located inside this territory, this approach is feasible if the study is to be carried out with the least possible bias.

The new sampling weights obtained in the calibration will be applied to a regression model using Raking calibration weights with all of the three auxiliary variables under consideration. The purpose of the regression is to obtain some measure of the effect that each dimension of the TCI-R has on the Nomophobia Questionnaire, with calibration playing an important role as it provides a certain level of safety in terms of being able to generalize the measured effects to the entire population. To test the hypothesis of whether the effects are null or significantly different from null, p-values from the Wald test (Wald, 1943) and its correction known as the working likelihood ratio (Rao and Scott, 1984) will be provided, as these are the recommended tests to apply when the sampling design is complex (Lohr, 2010).

2.4. *Questionnaire to Assess Nomophobia (QANIP; Olivencia-Carrión et al., 2018).*

This questionnaire was developed by Olivencia-Carrión et al. (2018) and consists of 11 items related to text message abuse, high frequency of use, spending more than 4 hours per day using the mobile phone (using the mobile phone all of the time) to cope with negative emotions or problems, to feel better, showing extreme nervousness and aggressive behaviour when deprived or unable to use the mobile phone, progressive deterioration in school/work and social and family functioning, and impairments in self and social perception. Each item is scored from one to five and they describe a four-factor structure according to the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) performed on the sample of participants described in Section 2.1: Factor 1 (Mobile Phone Abuse) consists of four items (1, 3, 7 and 8) that described 18% of the variance. Factor 2 (Loss of Control) involves three items (2, 5, and 6) that explained 11% of the variance. Factor 3 (Negative Consequences) contains three items (9, 10, and 11) that explained 10% of the variance. Finally, Factor 4 (Sleep Interference) consists of only one item (number 4) that explained 6% of the variance. Goodness-of-fit indices for EFA were 0.02 for RMSR, 0.976 for Tucker-Lewis Index (TLI), and 0.033 for RMSEA [CI 90% 0-0.57], while for CFA these were 0.045 for SRMR, 0.969 for Goodness-of-Fit Index (GFI), 0.941 for TLI and 0.053 for RMSEA [CI 90% 0.039-0.067]. The Cronbach's Alpha reliability coefficient value for the sample of the present study was 0.80. Convergent validity was assessed with item-total correlations, which were all significant, while discriminant validity was assessed testing the null hypothesis of mean equality between the upper and lower

groups of each item, which was rejected for all of the items. Further details on scale analysis and questionnaire validity can be found in Olivencia-Carrión et al. (2018). As noted previously, the sample of 968 participants was used for both the scale and factor analysis and for the weighted regression analysis.

2.5. *Temperament and Character Inventory Revised (TCI-R; Cloninger et al., 1993).*

This questionnaire consists of 240 items (5 of these on validity), with a 5-point Likert-type response scale, grouped into 4 temperament dimensions (NS, HA, RD, and P) and 3 character dimensions (SD, C and ST). This instrument has been validated in a general Spanish population (Gutiérrez-Zotes et al., 2004) and has satisfactory psychometric properties (Pelissolo et al., 2005).

3. Results

In order to meet required normality assumptions, Factors 2, 3 and 4 were log-transformed to reduce their original skewness. After these transformations, the residuals of every regression model presented in this section are normally distributed. Regression models were computed using R (R Core Team, 2017), and the packages “sampling” (Tillé and Matei, 2015) and “survey” (Lumley, 2014; Lumley, 2004). Partial correlations and R-squared coefficients were obtained using the SSE-based approach (Efron, 1978) and computed in R using the package “rsq” (Zhang, 2017). Linear regression models obtained for all of the factors of the scale using calibration weighting on the Andalusia population totals are displayed in Table 1.

INSERT TABLE 1 HERE

The main outcomes to emerge from these regression analyses are the following: a) Cooperativeness significantly reduces nomophobic levels, particularly for Factor 1, and b) Reward Dependence appears to increase nomophobic levels for all of the factors, but primarily for Factors 1 and 2, where its effect is significantly non-null.

The role of the remaining personality characteristics present in TCI-R is unclear according to the models. However, several results are worth noting: First, Novelty-Seeking was important for Factor 3 as a nomophobia-enhancing characteristic. Second, Harm Avoidance, Self-Transcendence, and Persistence (of marginal significance) were important for the same factor. Based on the R-squared values, the model for Factor 3 is the most explanatory (explaining 0.1460, i. e. 14.6% of the variability). However, R-squared values for all models are generally low, meaning that non-controlled variables could be having a great impact on nomophobia.

The model used to explain the behaviour of the total scale revealed that Reward Dependence and Cooperation are statistically significant contributors, with the former being positively linked to nomophobia, and the latter having a negative correlation with this pathology. Persistence also emerged as a marginally significant (in statistical terms) addiction enhancer.

4. Discussion

The main purpose of the present study was to examine the relationship between temperament and personality in Nomophobia. Our study showed that Cooperation (C) significantly reduces Nomophobic levels for two of the various factors measured (Mobile Phone Addiction and Negative Consequences), whereas RD appears to increase nomophobic levels for all factors. Other variables such as Novelty Seeking (NS), Harm Avoidance (HA) and Self-Transcendence (T) also show a positive, albeit weaker, relationship with Nomophobia. Similar results have been found in previous studies on behavioural addiction (Farré et al. 2015). Our results, however, tend to partially refute other previous findings. In particular, in our study we failed to find significant differences in terms of the Self Directedness (SD) dimension, although the Persistence (P) character dimension emerged as a marginally significant addiction enhancer.

The NS dimension increases the score on the Negative Consequences factor. These results have been observed in other studies of diverse substance and behavioural addictions (Farré et al., 2015; Gutiérrez et al., 2016; Lee et al., 2012; Lu et al., 2014; Reynolds et al., 2006). NS has been defined as the tendency to seek reward signals and strong new sensations about unknown stimuli. Individuals with high NS scores tend to be impulsive, enthusiastic, exploratory, and curious. Hence, individuals high on NS may be more likely to be involved in frequent communication by mobile phone, which is directly related to nomophobia.

Regarding HA, the present study confirmed that high scores tend to be associated with an increase in the Negative Consequences factor. HA is

considered as the tendency to respond to aversive stimuli with inhibition in order to avoid suffering, punishment, and frustration. High scorers are regarded as apprehensive worriers that have strong feelings of anxiety during unpredictable situations (Cross et al., 2011). Only a few studies have found an increase of HA in nomophobic individuals; nonetheless, the current results are consistent with other studies that have found a link between HA or feelings of anxiety with substance abuse or behavioral addiction (Mok et al., 2014; Gutiérrez et al., 2016). Thus, overall it appears that temperament and character can have a substantial impact on career, relationships, and mental health.

It is important to note that in the current study the RD dimension was higher in nomophobics, primarily in the Mobile Phone Addiction and Loss of Control Factors. RD is defined as the tendency to respond constantly and intensely to signals of reward and avoid punishment, showing a sensitivity to threat cues. It has also been further classified as a tendency towards pessimism and having feelings of anxiety in unpredictable situations. There are too little data in the literature on this dimension to determine if this finding could be linked to other studies. To our knowledge, the only available study for comparison is the one reported by Walther et al. (2012) that established lower levels of RD among Internet addicts. However, Aluja and Blanch (2011) associate RD with extraversion, and thus our results are consistent with the work of other authors (Olivencia-Carrión et al., 2016; Takao, 2014; Walther et al., 2012) who have found that extraversion predicts addictive behaviours.

The C character dimension emerges as a characteristic that significantly reduces levels of nomophobia, particularly for the factors of Mobile Phone

Addiction and Negative Consequences. In the present study, non-dependent excessive users were characterized by high levels of C, which suggests that this category includes people who are more socially tolerant, empathic, helpful, and compassionate. Thus, they may be more likely to have peers to communicate with (Lu et al., 2014) which has been suggested to be a protective factor for mental health (Gutiérrez et al., 2016). Individuals high on C have been described as socially tolerant, empathic, helpful, and compassionate, as opposed to intolerant, callous, unhelpful, and vengeful. Cooperativeness has been used to describe people who show unconditional acceptance of others, empathy with others' feelings, and willingness to help without a desire for selfish domination. Cloninger et al. (1993) regarded high cooperativeness as a sign of psychological maturity and advanced moral development. Cooperativeness is assessed using five subscales in the Temperament and Character Inventory: 1) Social acceptance vs. intolerance (C1); 2) Empathy vs. social disinterest (C2); 3) Helpfulness vs. unhelpfulness (C3); 4) Compassion vs. revengefulness (C4), and 5) Principles vs. self-advantage (C5). It has been found that drug dependence is associated with lower C scores (Evren et al., 2007). It has also been found that Schizophrenia patients have lower C scores than controls (Calvo de Padilla et al., 2006; Glatt et al., 2006; Molina et al., 2017). Similarly, most individuals with personality disorders (e.g., obsessive compulsive disorder) are low in C, show poor interpersonal functioning, and are described as intolerant, narcissistic, hostile or disagreeable, critical, unhelpful, or vengeful (Kim et al., 2009).

Finally, the ST character dimension appears increase the score on the factor of Negative Consequences. ST can be defined as having spiritual

maturity and the desire for spiritual realization, along with the capacity for meditation and non-materialistic thinking. Moreover, it has been linked to high levels of life satisfaction, which was highlighted in some studies (Cloninger et al., 1993) mentioned in the literature review.

Nomophobia can be considered within the framework of non-substance behaviour addictions. It could be described as a syndrome analogous to substance addiction, but with a focus on a certain behaviour which, similar to substance consumption, produces short-term reward and may persist despite harmful consequences (due to diminished control over the behaviour). The DSM-5 (APA, 2013) broadens the category of "Substance-Related Disorders" to "Substance Use and Addictive Disorders" including substance and non-substance-related addictions. However, non-substance behaviour addictions currently only include pathological gambling.

There are no specific and agreed diagnostic criteria for non-substance behaviour addictions like Nomophobia, although clinical experience shows that the excessive use of new technologies is a real problem that seriously affects certain individuals. Once again, history repeats itself: Gambling was recognized as a nosological entity in 1980, when the APA introduced it under the name of "pathological gambling"; however, its existence was recognized by professionals much earlier. Currently only pathological gambling is recognized as a non-substance behaviour addiction, whereas the remaining addictions without substance use (such as the newly emerged internet and mobile phone use) are still subject to controversy and confusion. However, from clinical experience, it is clear that the abusive use of new technologies (mobile or

internet) is a real problem that seriously affects people who suffer from it (Sánchez-Carbonell et al., 2008).

The acknowledgement of behavioural addictions can be traced as far back as Marlatt et al. (1988) who referred to a repetitive habit pattern that increases the risk of disease and/or associated personal and social problems. Addictive behaviours are often experienced subjectively as a loss of control and persistence of the behaviour despite volitional attempts to abstain or achieve moderate use. Furthermore, in the last decade, a growing amount of research has established psychological and neurobiological similarities between the excessive practice of these behaviours (e.g., mobile phone abuse/nomophobia, shopping, sex, internet, video gambling, and eating) and addictive patterns of use (Billieux et al., 2010; Mentzoni et al., 2011). Research on the neurobiology of addiction has revealed the existence of a common mechanism between substance addictions and behavioural addictions (Leeman and Potenza, 2013; Weinstein and Lejoyeux, 2015). The problem is that the relationship between the substances that are included within the diagnostic criteria and those behaviours that are supposed to be addictive is unknown, because the latter are not included in the DSM-5. However, there is now enough evidence to suggest that alcohol, drugs, and pathological gambling are not the only crippling addictions. Addiction statistics are scarce because many destructive habits are not yet officially recognized as addictions, these include mobile phone addiction/nomophobia, gaming, eating, shopping, and sex, all of which are problematic for a number of reasons. Some of them involve direct manipulation of pleasure through the use of products that are ingested into the body, such as drug use disorders and food-related disorders. The difficulty we have is that we

do not know to what extent these behaviours are addictive because they are not included in the DSM-5 (APA, 2013) or any other diagnostic tool. Nevertheless, the aim of our study was to examine the relationship between temperament and personality in Nomophobia. This in turn commits us to advance along the path of Nomophobia research and treatment. A definition of Nomophobia must take into account the following symptoms: text message abuse; high frequency of use, spending more than 4 hours per day using the mobile phone (using the mobile phone all of the time) to cope with negative emotions or problems or to feel better; showing extreme nervousness and aggressive behaviour when deprived of or unable to use the mobile phone; progressive deterioration in school/work and social and family functioning; and impairment in self and social perception.

Our results should be evaluated in the context of several limitations including that the Questionnaire to Assess Nomophobia (QANIP; Olivencia-Carrión et al., 2018) employed in the present study requires further psychometric evaluation. Nevertheless, the scale has been found to have excellent psychometric properties and offers a concise measure of nomophobia for use in future studies. Third, even those individuals who are interested in seeking therapeutic change and admit to negative personality characteristics sometimes portray themselves in an overly positive light. Thus, when nomophobes are rewarded for a positive presentation of themselves, the possibility for a dishonest response style increases. Therefore, one limitation of this study refers to the accuracy of participants' responses, since all of our measures relied upon self-report.

5. Conclusion

There is a relationship between Nomophobia and personality. In particular, the probability of presenting Nomophobia increases when an individual has high RD scores, and decreases when the person has high C scores. Other variables such as NS, HA and ST also appear to show positive, albeit weaker, relationships with several Nomophobic factors. Undoubtedly, prevention and/or intervention techniques should target personality traits, since these appear to have an impact on the development of nomophobia.

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Declaration of Interest

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References

- Afifi, A.A., Azen, S.P. 1972. Statistical analysis: a computer oriented approach. New York: Academic Press.
- Aluja, A., Blanch, A. 2011. The five and seven factors personality models: differences and similitude between the TCI-R, NEO-FFI-R and ZKPQ-50-CC. *Span. J. Psychol.* 2, 659-666.
- American Psychiatric Association. 2013. The Diagnostic and Statistical Manual of Mental Disorders: DSM-5. US: Bookpoint.
- Arnau, M.M., Mondon, S., Santacreu, J.J. 2008. Using the temperament and character inventory (TCI) to predict outcome after inpatient detoxification during 100 days of outpatient treatment. *Alcohol.* 43, 583-588.
- Bianchi, A., Phillips, J.G. 2005. Psychological predictors of problem mobile phone use. *Cyberpsychol. Behav.* 8, 39-51.
- Billieux, J., Gay, P., Rochat, L., Van der Linden, M. 2010. The role of urgency and its underlying psychological mechanisms in problematic behaviours. *Behav Res Ther*, 48, 1085–1096. <http://dx.doi.org/10.1016/j.brat.2010.07.008>.
- Cabrera-León, A., Lopez-Villaverde, V., Rueda, M. Moya-Garrido, M.N. 2015. Calibrated prevalence of infertility in 30- to 49-year-old women according to different approaches: a cross-sectional population-based study. *Hum. Reprod.* 30(11):2677-85.
- Cabrera-León, A., Rueda, M., Cantero-Braojos M. 2017. Calibrated prevalence of disabling chronic pain according to different approaches: a face-to-face cross-sectional population-based study in Southern Spain. *BMJ Open* 7(1):e014033.
- Cassel, C.M., Sarndal, C.E., Wretman, J.H. 1976. Some results on generalized difference estimation and generalized regression estimation for finite population. *Biometrika.* 63, 615-620.
- Calvo de Padilla, M., Padilla, E., Alemán, G.G., Bourdieu, M., Guerrero, G., Strejilevich, S., Escobar, J.I., Svrakic, N., Cloninger, C.R., de Erausquin, G.A. 2006. Temperament traits associated with risk of schizophrenia in an indigenous population of Argentina. *Schizophr. Res.* 2006;83:299–302.
- Cloninger, C.R., Svrakic, D.M., Przybeck, T.R. 1993. A psychobiological model of temperament and character. *Arch. Gen. Psychiatry.* 50, 975-990.
- Cross, C.P., Copping, L.T., Campbell, A. 2011. Sex differences in impulsivity: a meta-analysis. *Psychol. Bull.* 137, 97-130.

- Dixit, S., Shukla, H., Bhagwat, A., Bindal, A., Goyal, A., Zaidi, A.K., Shrivastava, A. 2010. A study to evaluate mobile phone dependence among students of a medical college and associated hospital of central India. *Indian J. Community Med.* 35, 339-341.
- Efron, B. 1978. Regression and ANOVA with zero-one data: measures of residual variation. *J. Am. Stat. Assoc.* 73, 113-121.
- Evren, C., Evren, B., Yancar, C., Erkiran, M. 2007. Temperament and character model of personality profile of alcohol- and drug-dependent inpatients. *Compr. Psychiatry.* 48(3):283-8.
- Farré, J., Fernández-Aranda, F., Granero, R., Aragay, N., Mallorquí-Bague, N., Ferrer, V, et al. 2015. Sex addiction and gambling disorder: similarities and differences. *Compr. Psychiatry,* 56, 59-68.
- Forgays, D.K., Hyman, I., Schreiber, J. 2014. Texting everywhere for everything: Gender and age differences in cell phone etiquette and use. *Comput. Hum. Behav.* 31, 314-321.
- Gat-Lazer, S., Geva, R., Gur, E., Stein, D. 2017. Reward Dependence and Harm Avoidance among Patients with Binge-Purge Type Eating Disorders. *Eur. Eat. Disord. Rev.* 25, 205-213.
- Glatt, S.J., Stone, W.S., Faraone, S.V., Seidman, L.J., Tsuang, M.T. 2006. Psychopathology, personality traits and social development of young first-degree relatives of patients with schizophrenia. *Brit J Psychiatry,* 189:337–345.
- Gutiérrez-Zotes, J.A., Bayón, C., Montserrat, C., Valero, J., Labad, A., et al. 2004. Temperament and Character Inventory Revised (TCI-R). Standardization and normative data in a general population sample. *Actas Esp. Psiquiatr.* 32, 8-15.
- Gutiérrez, F., Gárriz, M., Peri, J.M, Vall, G., Torrubia, R. 2016. How temperament and character affect our career, relationships, and mental health. *Compr. Psychiatry.* 6, 181-189.
- Kim, S.J., Kang, J.I., Kim, C.H. 2009. Temperament and character in subjects with obsessive-compulsive disorder. *Compr. Psychiatry,* 50:567-572.
- King, A.L., Valença, A.M., Silva, A.C., Sancassiani, F., Machado, S, Nardi, A.E. 2014. "Nomophobia": impact of cell phone use interfering with symptoms and emotions of individuals with panic disorder compared with a control group. *Clin. Pract. Epidemiol. Ment. Health.* 10, 28-35.
- Kim, Y., Jeong, J., Cho, H., Jung, D., Kwak, M., Rho, M.J, et al. 2016. Personality Factors Predicting Smartphone Addiction Predisposition: Behavioural Inhibition and Activation Systems, Impulsivity, and Self-Control. *PLoS One,* 08;11(8).

- Ko, C.H., Hsiao, S., Liu, G.C., Yen, J.Y., Yang, M.J., Yen, C.F. 2010. The characteristics of decision making, potential to take risks, and personality of college students with Internet addiction. *Psychiatry Res.* 175, 121-125.
- Kuss, D.J., Griffiths, M.D., Karila, L., Billieux, J. 2014. Internet addiction: a systematic review of epidemiological research for the last decade. *Curr. Pharm. Des.* 20, 4026-4052.
- Lee, H.W., Choi, J.S., Shin, Y.C., Lee, J.Y., Jung, H.Y., Kwon, J.S. 2012. Impulsivity in internet addiction: a comparison with pathological gambling. *Cyberpsychol. Behav. Soc. Netw.* 15, 373-377.
- Leeman, R. F. Potenza, M.N. 2013. A targeted review of the neurobiology and genetics of behavioural addictions: An emerging area of research. *Can. J. Psychiatry*, 58(5), 260-273.
- López-Torrecillas, F., Perales, J.C., Nieto-Ruiz, A., Verdejo-García, A. 2014. Temperament and impulsivity predictors of smoking cessation outcomes. *PLoS One*, 9(12):e112440.
- López-Torrecillas, F., Nieto-Ruiz, A., Velasco-Ortuño, S., Lara-Fernández, M., López-Quirantes, E.M., Castillo-Fernández, E. 2014. The role of impulsivity in dropout from treatment for cigarette smoking. *Compr. Psychiatry*, 55, 1609-1613.
- Lohr, S.L. 2010. *Sampling: Design and Analysis*. 2nd ed. Boston: Brooks/Cole.
- Lu, X., Katoh, T., Chen, Z., Nagata, T., Kitamura, T. 2014. Text messaging: are dependency and Excessive Use discretely different for Japanese university students?. *Psychiatry Res.* 15, 255-262.
- Lumley, T. 2004. Analysis of complex survey samples. *J. Stat. Softw.*, 9, 1-19.
- Lumley, T. 2014. *Survey: analysis of complex survey samples*. R package version 3.30.
- Marlatt, G. A., Baer, J. S., Donovan, D. M., Kivlahan, D. R. 1988. Addictive behaviours: Etiology and treatment. *Annu. Rev. Psychol.*, 223-252.
- Mentzoni, R. A., Brunborg, G. S., Molde, H., Myrseth, H., Skouvrøe, K. J.M., Hetland, J. & Pallesen, S. 2011. Problematic video game use: estimated prevalence and associations with mental and physical health. *Cyberpsychol. Behav. Soc. Netw.*, 14(10):591-596.
- Mok, J.Y., Choi, S.W., Kim, D.J., Choi, J.S., Lee, J., Ahn, H., et al. 2014. Latent class analysis on internet and smart- phone addiction in college students. *Neuropsychiatr. Dis. Treat.* 10, 817-828.
- Molina, J.L., Calvó, M., Padilla, E., Balda, M., Alemán, G.G., Florenzano, N.V., Guerrero, G., Kamis, D., Rangeon, B.M., Bourdieu, M., Strejilevich, S.A., Conesa, H.A., Escobar, J.I., Zwir, I., Cloninger, C.R., de Erausquin, G.A. 2017.

Parkinson an motor impairment predicts personality domains related to genetic risk and treatment outcomes in schizophrenia. *NPJ Schizophr.*, 11;3:16036.

Nagpal, S.S., Kaur, R. 2016. Nomophobia: The problem lies at our fingertips. *Indian J. Public Health W.* 12, 1135-1139.

Olivencia-Carrión, M.A, Pérez-Marfil, M.A, Ramos-Revelles, B., Lopez-Torrecillas, F. 2016. Relation Personality to Mobile Phone Use and Abuse. *Accion Psicol.* 13, 109-118.

Olivencia- Carrión, MA, Ferri-García, R., Rueda, M., López-Torrecillas, F. 2018. Reliability and Construct Validity of a Questionnaire to Assess the Nomophobic (QANIP). *BMC Public Health.* (In revision).

Osborne, J. 2005. Notes on the use of data transformations. *PARE*, 5, 42-50.

Park, H., Suh, B.S., Kim, W.S., Lee, H., Park, S., Lee, K. 2015. Character profiles and life satisfaction. *Compr. Psychiatry.* 04, 172-177.

Pedrero-Pérez, E.J., Ruiz-Sánchez de León, J.M. 2013. Subjective memory complaints, personality and prefrontal symptomatology in young adults. *Rev. Neurol.* 57, 289-296.

Pelissolo, A., Mallet, L., Baleyte, J.M., Michel, G., Cloninger, C.R, et al. 2005. The Temperament and Character Inventory-Revised (TCI-R): psychometric characteristics of the French version. *Acta Psychiatr. Scand.* 112, 126-133.

Pombo, S., Ferreira, J., Levy, P.Q., Bicho, M. 2017. Is there a genetic support for the Cloninger (type I/II) clinical classification of alcohol addiction? *Psychiatry Res.* 12. pii: S0165.

Rao, J.N.K, Scott, A.J. 1984. On Chi-squared Tests For Multiway Contingency Tables with Proportions Estimated From Survey Data. *Ann. Stat.* 12, 46-60.

Reynolds, B., Ortengren, A., Richards, J.B., de Wit, H. 2006. Dimensions of impulsive behaviour: Personality and behavioural measures. *Pers. Individ. Dif.* 40, 305-315.

Sanchez-Carbonell, X., Beranuy, M., Castellana, M., Chamarro, A. y Oberst, U. 2008. Internet and cell phone addiction: passing fad or disorder?. *Adicciones*, 20, 149-159.

Särndal, C.E. 2007. The calibration approach in survey theory and practice, *Surv. Methodol.* 33, 99-119.

Sidak, Z.K. 1967. Rectangular Condence Regions for the Means of Multivariate Normal Distributions. *J. Am. Stat. Assoc.* 62, 626-633.

Szyjkowska, A., Gadzicka, E., Szymczak, W., Bortkiewicz, A. 2014. The risk of subjective symptoms in mobile phone users in Poland: An epidemiological study. *Int. J. Occup. Med. Environ. Health*. 04;27(2):293-303.

Tabachnick, B.G., Fidell, L.S. 2000. Using multivariate statistics. 4th ed. Boston: Allyn & Bacon.

Thomé, S., Härenstam, A., Hagberg, M. 2011. Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults--a prospective cohort study. *BMC Public Health*. 31:11-66.

Takao, M. 2014. Problematic mobile phone use and big-five personality domains. *Indian J. Community Med*. 39, 111-113.

Tillé, Y., Matei, A. 2015. sampling: Survey Sampling. R package version 2.7. <http://CRAN.R-project.org/package=sampling>

Vitoratou, S., Ntzoufras, I., Theleritis, C., Smyrnis, N., Stefanis, N.C. 2015. Temperament and character dimensions assessed in general population, in individuals with psychoactive substance dependence and in young male conscripts. *Eur. Psychiatry*, 30, 474-479.

Wald, A. 1943. Tests of statistical hypotheses concerning several parameters when the number of observations is large. *Trans. Am. Math. Soc.* 54, 426-482.

Wang, P., Liu, T., Ko, C., Lin, H., Huang, M., Yeh, Y., et al. 2014. Association between Problematic Cellular Phone Use and Suicide: The Moderating Effect of Family Function and Depression. *Compr. Psychiatry*. 55, 342-348.

Walther, B., Morgenstern, M., Hanewinkel, R. 2012. Co-occurrence of addictive behaviours: personality factors related to substance use, gambling and computer gaming. *Eur. Addict. Res.* 18, 167-174.

Weinstein, A., Lejoyeux, M. 2015. New developments on the neurobiological and pharmacogenetic mechanisms underlying internet and videogame addiction. *Am. J. Addict.*, 24(2), 117-125.

Wu, A.M., Cheung, V.I., Ku, L., Hung, E.P. 2013. Psychological risk factors of addiction to social networking sites among Chinese smartphone users. *J. Behav. Addict.* 2, 160-166.

Zhang, D. 2017. rsq: R-Squared and Related Measures. R package version 1.0. <https://CRAN.R-project.org/package=rsq>

		Factor 1	Factor 2	Factor 3	Factor 4	Total scale
		(Mobile Phone Abuse)	(Loss of Control)	(Negative Consequences)	(Sleep Interference)	
(Intercept)	β_0	11.55***	1.89***	1.57***	1.20***	24.10***
	Std. Err.	(0.14)	(0.02)	(0.02)	(0.02)	(0.32)
Novelty-Seeking	β_1	0.24	0.00	0.05**	-0.05	0.40
	Std. Err.	(0.20)	(0.04)	(0.02)	(0.03)	(0.48)
	Partial cor.	0.1852	0.0990	0.2080	-0.1239	0.1449
Harm Avoidance	β_2	0.20	0.01	0.05*	-0.05	0.43
	Std. Err.	(0.22)	(0.04)	(0.02)	(0.05)	(0.57)
	Partial cor.	0.1778	0.1003	0.1575	-0.0642	0.1423
Reward Dependence	β_3	0.44**	0.06*	0.03 ⁺	0.01	1.04**
	Std. Err.	(0.17)	(0.02)	(0.01)	(0.02)	(0.36)
	Partial cor.	0.2561	0.1947	0.1529	0.0000	0.2388
Persistence	β_4	0.20	0.04	0.04 ⁺	-0.00	0.73 ⁺
	Std. Err.	(0.18)	(0.03)	(0.02)	(0.02)	(0.41)
	Partial cor.	0.1862	0.1529	0.1694	0.0000	0.1806
Self-Directedness	β_5	0.29	-0.02	0.01	0.01	0.26
	Std. Err.	(0.19)	(0.03)	(0.02)	(0.03)	(0.45)
	Partial cor.	0.1950	-0.1023	0.1126	0.0000	0.1386
Cooperativeness	β_6	-0.57**	-0.03	-0.04*	-0.03	-1.12*
	Std. Err.	(0.20)	(0.02)	(0.02)	(0.03)	(0.44)
	Partial cor.	-0.2732	-0.1341	-0.1654	-0.0781	-0.2295
Self-Transcendence	β_7	0.05	-0.01	0.07***	-0.03	0.24
	Std. Err.	(0.15)	(0.02)	(0.02)	(0.03)	(0.35)
	Partial cor.	0.1689	-0.1026	0.2540	-0.0619	0.1366
SSE-based R-squared		0.0977	0.0474	0.1460	0.0530	0.0833
Model deviance		5047.79	110.36	54.75	97.54	27106.17
Dispersion		5.26	0.12	0.06	0.10	28.27
Number of observations (n)		960	960	960	960	960

***p < 0.001, **p < 0.01, *p < 0.05, +p < 0.1

Table 1: Regression models weighted with Ranking calibration on age group, gender, and education level for Andalusia