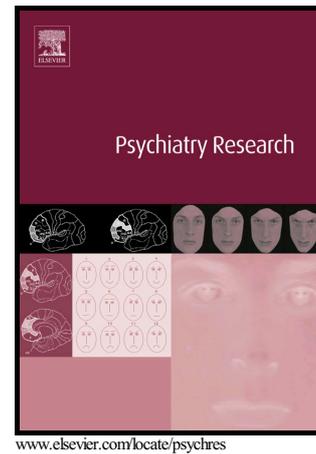


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**Examining sex differences in DSM-IV narcissistic personality disorder symptom
expression using Item Response Theory (IRT)**

Running title: Narcissistic personality disorder symptom expression

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Contributors: NH, HP and FL designed the study. HP undertook statistical analyses. NH, HP and PL wrote the first draft of the manuscript. CB, CGL, MR, JPS, CL, RD and FL reviewed the draft. All authors contributed to and have approved the final manuscript.

Abstract

The limited published literature on the subject suggests that there may be differences in how females and males experience narcissistic personality disorder (NPD) symptoms. The aim of this study was to use methods based on item response theory to examine whether, when equating for levels of NPD symptom severity, there are sex differences in the likelihood of reporting DSM-IV-TR NPD symptoms. We conducted these analyses using a large, nationally representative sample from the USA ($n=34,653$), the second wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). There were statistically and clinically significant sex differences for 2 out of the 9 DSM-IV-TR NPD symptoms. We found that males were more likely to endorse the item 'lack of empathy' at lower levels of narcissistic personality disorder severity than females. The item 'being envious' was a better indicator of NPD severity in males than in females. There were no clinically significant sex differences on the remaining NPD symptoms. Overall, our findings indicate substantial sex differences in narcissistic personality disorder symptom expression. Although our results may reflect sex-bias in diagnostic criteria, they are consistent with recent views suggesting that narcissistic personality disorder may be underpinned by shared and sex-specific mechanisms.

Key words: narcissistic personality disorder; narcissism; symptoms; expression; sex; gender; empathy; envious; item response theory (IRT); differential item functioning (DIF).

Examining sex differences in DSM-IV-TR narcissistic personality disorder symptom expression using Item Response Theory (IRT)

1. Introduction

Narcissistic personality disorder (NPD) is characterized by a pervasive pattern of grandiosity (in fantasy or behavior), need for admiration and lack of empathy (American Psychiatric Association, 2013), albeit there is important heterogeneity in symptom profiles (Caligor et al., 2015; Gabbard and Crisp-Han, 2016; Russ et al., 2008). Although this disorder is estimated to affect 7.7% of males and 4.8% of females in the general population (Stinson et al., 2008) and is associated with substantial functional impairment and psychosocial disability (Stinson et al., 2008), it remains one of the least studied personality disorders (Caligor et al., 2015).

Few studies have examined whether NPD symptom expression differs between males and females. Prior research suggests substantial sex differences, with males more likely to have a sense of entitlement, a lack of empathy (Karterud et al., 2011; Richman and Flaherty, 1990), fantasies of power and success and a grandiose sense of self-importance (Bylsma and Major, 1992; Grijalva et al., 2015; Karterud et al., 2011; Luo et al., 2014; Major, 1994; Major et al., 1984), and to exploit others and to believe that they are special or deserve unique privileges (Grijalva et al., 2015; O'Brien et al., 2012; Richman and Flaherty, 1990; Tschanz et al., 1998). Females tend to exhibit greater concern with physical appearance (Buss and Chiodo, 1991) and have higher reactivity to slights from others (Richman and Flaherty,

1990). Males and females with NPD appear to present similar prevalence of symptoms such as vanity, self-absorption and envy (Karterud et al., 2011; Foster et al. 2003).

Limitations to the extant literature include the reliance of most studies on convenience samples (Bylsma and Major, 1992; Foster et al., 2003; Grijalva et al., 2015; Major, 1994; Major et al., 1984; O'Brien et al., 2012), incomplete evaluation of DSM-IV NPD symptoms and lack of control for overall NPD symptom severity (Bylsma and Major, 1992; Karterud et al., 2011; Major, 1994; Major et al., 1984; O'Brien et al., 2012). This last concern is critical because several studies (Foster et al., 2003; Fossati et al., 2005; Grijalva et al., 2015; Grilo et al. 1998; Kubarych et al., 2010; Lynam and Widiger, 2007; Miller et al., 2007; Paulhus and Williams, 2002; Torgersen et al., 2001; Tschanz et al., 1998), although not all (Barnett and Kendall, 2017; Furnham, 2006; Wright et al., 2010), have shown that males exhibit higher levels of narcissism than females. Therefore, it is unclear whether sex differences in symptom expression are due to true phenomenological differences between females and males, or reflect greater overall symptom severity in one sex than in the other.

Methods based on item response theory (IRT) (Lord, 1980) allow to examine the likelihood that a particular symptom will be endorsed at a particular level of narcissistic personality severity. Thus, differences in symptom endorsement between groups can be evaluated while equating for levels of NPD symptom severity. Application of IRT methods is emerging in the evaluation of DSM diagnostic criteria, including criteria for alcohol dependence (Kahler et al., 2003), nicotine dependence (Saha et al., 2010; Shmulewitz et al., 2011), amphetamine, cocaine, and prescription drugs (Saha et al., 2012), unipolar and bipolar depression (Aggen et al., 2005; Hoertel et al., 2015, 2016; Simon and Von Korff, 2006; Uebelacker et al., 2009, 2010; Weinstock et al., 2009, 2010), mania (Carragher et al., 2013), personality disorders (Ackerman et al., 2012; Harford et al., 2013; Hoertel et al., 2014), post-

traumatic stress disorder (Rivollier et al., 2015), bulimia (Rowe et al., 2002) and attention-deficit/hyperactivity disorder (Peyre et al., 2014).

Few studies applied IRT methods to examine sex differences in NPD symptoms. A prior study (Ackerman et al., 2012) examined sex differences in Narcissistic Personality Inventory (NPI) item functioning in a large sample of American students using IRT methods. This study found that several NPI items (including “I find it easy to manipulate people”, “I have a strong will to power”, “If I ruled the world it would be a much better place”, “I am apt to show off if I get the chance” and “I know I am good because everyone keeps telling me so”) were endorsed by males at lower levels of NPD severity. Another study (Kubarych et al., 2010) based on a sample of 2794 Norwegian twins suggested that males tend to require higher levels of NPD severity compared to females before they endorse the item “need for admiration”.

To our knowledge, no study to date has used IRT methods to examine whether DSM criteria for NPD function differently in females and males in a large general population sample. If differences exist, identifying them will help to ensure that the construct of NPD is appropriately understood and assessed in females and males.

Accordingly, this study aimed to fill this gap of knowledge by using IRT methods to examine whether, when equating for levels of NPD severity, there are sex differences in the likelihood of reporting DSM-IV-TR NPD symptoms. We conducted these analyses using a large, nationally representative sample of US adults, the second wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).

2. Methods

2.1. Sample

Respondents were drawn from the second wave (2004–2005) of the NESARC (Grant et al., 2009), a representative sample of the adult population of the United States described in detail elsewhere (Grant et al., 2004a, 2004b, 2009). Wave 1 of the NESARC was a nationally representative face-to-face survey of 43,093 civilian noninstitutionalized U.S. residents aged 18 years and older, conducted in 2001–2002 by the U.S. Census Bureau under the direction of the National Institute on Alcoholism and Alcohol Abuse (NIAAA). Of those who were eligible, i.e., alive, still resident in the United States, not on active military duty, and not too physically or mentally impaired to participate, 34,653 (87%) were successfully reinterviewed at Wave 2 (Grant et al., 2009). The cumulative response rate at Wave 2 was 70.2%. Data were weighted to be representative of the U.S. population for various sociodemographic variables (including age, sex and race/ethnicity), based on the 2000 Decennial Census. The research protocol, including informed consent procedures, received full human subjects review and approval from the US Census Bureau and the Office of Management and Budget (Grant et al., 2009).

2.2. Narcissistic personality disorder symptoms assessment

Narcissistic personality disorder symptoms were assessed in Wave 2 using the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) using the *NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV* (AUDADIS-IV), a fully structured diagnostic interview designed for experienced interviewers who are not clinicians (Grant et al., 2004a, 2004b). At the time of Wave 2 Interview, all participants were asked a series of NPD symptom questions about how they felt or acted most of the time throughout their lives, regardless of the situation or whom they were with. They were asked not to include symptoms occurring only when they were depressed, manic, anxious, drinking heavily, using medicines or drugs, experiencing withdrawal symptoms or physically ill. To

receive a diagnosis of NPD, respondents had to endorse the requisite number of DSM-IV criteria, at least 1 of which must have caused social or occupational dysfunction (Stinson et al., 2008). NESARC estimate of prevalence of NPD was 6.2% (Stinson et al., 2008). Test-retest reliability of AUDADIS-IV NPD diagnosis was good ($\kappa=0.70$, $SE=0.09$) and intraclass test-retest reliability coefficient was within the good range (95% ICC=[0.67-0.75], $\alpha=0.77$) (Ruan et al., 2008).

Analyses for this study focused on the 9 DSM-IV NPD symptoms (**Table 1**). Since all individuals were asked about these symptoms, the full NESARC sample was included in our analyses.

2.3. Analyses

2.3.1. Prevalence of NPD symptoms by sex

Sex differences in prevalence of each NPD symptom in the full NESARC sample were tested using chi-square tests.

2.3.2. Assessing unidimensionality

Eigenvalue analysis of the tetrachoric correlation matrices of the nine NPD symptoms was performed separately in males and females. A scree plot with an elbow after the first eigenvalue and a well-fitting one-factor model according to standard goodness of fit tests (RMSEA<0.05, TLI>0.95 and CFI>0.95) were used to indicate unidimensionality.

2.3.3. Item response theory (IRT)

Item response theory modeling was conducted to examine whether the symptoms of NPD were endorsed similarly in females and males after adjusting for differences in

underlying NPD severity (Weinstock et al., 2009; Harford et al., 2013). We used a two-parameter model estimating the following for each symptom: (i) a severity parameter to describe the point on the latent continuum representing the severity of NPD where a symptom has a probability of 50% of being endorsed, and (ii) a discrimination parameter to describe how rapidly the probability of observing the symptom changes across increasing levels of the latent severity continuum [i.e., the slope of the item response function (IRF), so that a steeper slope indicates a better ability of the symptom to signal a particular level of overall severity]. We performed statistical analyses using Mplus 7.2 (Muthén and Muthén, 2007) to account for the NESARC's complex design features. The default estimator for the analysis was the variance-adjusted weighted least squares (WLSMV), a robust estimator appropriate for categorical observed variables such as the ones used in this study (Muthén and Muthén, 2007).

2.3.4. Testing differential item functioning (DIF)

Multisample confirmatory factor analysis was used to test the DIF between males and females of (a) factor loadings (i.e., item discrimination parameters) and (b) thresholds (i.e., severity parameters). The different models varied in terms of the parameters constrained to be equal between males and females (Millsap and Yun-Tein, 2004). Initially, an unconstrained model was fit allowing all parameters to differ between females and males (**Table 2**). Following a method previously described by McBride and colleagues (McBride et al., 2010), analyses were conducted iteratively to determine which IRT parameters differed between sexes. Nested models were compared using the chi-square difference test (implemented using the DIFFTEST option in Mplus). To explore for DIF in IRT parameters of one item, the discrimination and severity parameters of the others items were constrained to be equal between males and females. For each item, a chi-square difference test DIF comparing models

with and without the discrimination parameter of the item constrained to be equal between males and females was used to identify DIF in the discrimination parameter (the severity parameter of the item was freely estimated between males and females in both models). To identify DIF in the severity parameter, a chi-square difference test DIF was used to compare models with and without the severity parameter of the item constrained to be equal between males and females (the discrimination parameter constrained to be equal between males and females in both models).

Due to multiple comparisons implemented in this study, we set alpha at 0.05 and used the Benjamini–Hochberg procedure to adjust p -values for all 1 df tests (Benjamini and Hochberg, 1995). Small differences in severity between groups could be statistically significant but may not be clinically meaningful (Strong et al., 2009). Thus, it was decided *a priori* that only differences greater than 0.25 in symptom discrimination and severity would be considered clinically meaningful (Steinberg and Thissen, 2006). Such differences in symptom severity can be interpreted as one quarter of the “standard unit difference between the value of the (underlying) trait necessary to have a 50–50 chance of responding positively in one group compared to another” (Steinberg and Thissen, 2006). Minimum sample size for DIF analyses is usually considered in the range of 100–200 subjects per group (Zumbo, 1999). Based on a simulation study, Scott et al. (Scott et al., 2010) recommended a minimum of 200 participants per group to ensure adequate performance (i.e., 80% power).

2.3.5. Total test information (TIF)

The TIF and the standard error of measurement (SEM, which is equal to the inverse square root of the TIF) were estimated for each group on each latent trait. The TIF is a graphic representation of the total quantity of information yielded by a set of items at each latent trait level. The area under the TIF curve (AUC) corresponds to the total amount of information

provided by the set of items. The standard error of measurement is related to the reliability of the measurement and is equal to the square root of 1 minus reliability (e.g., a SEM of 0.55 is equal to an internal consistency of 0.70) (Weiss and Davison, 1981). The TIF and the SEM represent the information and precision of a set of items across different levels of a latent trait.

3. Results

3.1. *Sample characteristics*

Of the 34,653 participants, 177 (0.48%, SE=0.10) did not answer for at least one NPD item question and were excluded from the analyses. In the sample of 34,476 remaining participants, mean age in females (n=19,975) and in males (n=14,501) was 49.0 years (SE=0.2) and 47.2 years (SE=0.2) respectively. The racial-ethnic distribution in females was as follows: non-Hispanic White 70.6%, non-Hispanic Black 11.9%, Hispanic 10.9%, non-Hispanic Asian/Native Hawaiian/Other Pacific Islander 4.2% and Native American 2.3%. In males, this distribution was: non-Hispanic White 71.2%, non-Hispanic Black 10.1%, Hispanic 12.3%, non-Hispanic Asian/Native Hawaiian/Other Pacific Islander 4.4% and Native American 2.1%. With regard to education, 58.3% of females and 58.7% of males had completed college or higher.

3.2. *NPD symptoms endorsement rates*

In the full sample, the most frequently endorsed DSM-IV symptoms in both males and females were “lack of empathy”, “grandiose sense of self-importance”, “sense of entitlement”, while the criteria “preoccupied with fantasies” and “arrogant/haughty behaviors/attitudes” were the least commonly reported (**Table 1**). The prevalence rates of “lack of empathy”, “sense of entitlement”, “interpersonally exploitative”, “believes he/she is special/unique” and “preoccupied with fantasies” were significantly higher in males compared

to females, whereas “being envious” was significantly greater in females than in males. The prevalence of NPD was significantly greater in males than in females.

3.3. Unidimensionality of NPD symptoms

In both males and females, fit indices indicated an adequate fit to the data (in males: first factor eigenvalue=5.9, second factor eigenvalue=0.6, CFI=0.996, TLI=0.994, RMSEA=0.011; in females: first factor eigenvalue=5.6, second factor eigenvalue=0.7, CFI=0.990, TLI=0.986, RMSEA=0.014). Based on an adequate fit of the unidimensional model to the data, analyses proceeded to testing model parameters for invariance.

3.4. IRT item parameters

The ranking of IRT parameters was similar between males and females (Spearman's correlation coefficients were 0.95 for severity parameters [differences of rank ≤ 2] and 0.80 for discrimination parameters [differences of rank ≤ 3]) (**Table 2**).

3.5. Differential item functioning (DIF)

Two of the nine NPD symptoms exceeded our criteria for both clinical and statistical significance in DIF: the symptom ‘lack of empathy’ for the severity parameter only and the symptom ‘being envious’ for the discrimination parameter only.

Inspection of the item response curves (IRC) for these 2 symptoms (**Figures 1 and 2**) revealed that: (i) given equivalent levels of NPD severity, males were consistently more likely to report ‘lack of empathy’ compared to females and (ii) the symptom ‘being envious’ appeared to discriminate better NPD severity in males than in females.

3.6. Test information function (TIF)

The TIF curve for males was slightly higher at its peak than the TIF curve of females and the area under the TIF curve (AUC) was also 6.7% higher in males than in females, indicating that DSM-IV symptoms for NPD provide slightly more information in males than in females (**Figure 3**).

4. Discussion

The aim of this study was to evaluate sex differences in the likelihood of reporting DSM-IV NPD symptoms using an IRT-based methodology. The benefit of the IRT-based approach is that it accounts for differences in NPD severity in evaluating potential sex differences. Additional strengths of this study include the use of a large representative sample, the incorporation in our analyses of information from the sampling methods of the survey design which has been suggested to substantially improve standard error estimates and tests of model fit (Asparouhov, 2005), the use of an *a priori* defined threshold of clinical significance, and the fact that all participants were asked about all DSM-IV NPD symptoms, allowing us to examine the full narcissistic personality spectrum.

Our analyses revealed statistically and clinically significant sex differences in 2 out of 9 DSM-IV NPD symptoms. The direction of associations suggested that males were more likely to report ‘lack of empathy’ at lower levels of NPD severity than females. Being envious appeared to significantly better discriminate the level of NPD severity in males than in females.

It is notable that our results are consistent with recent studies suggesting that NPD might be understood as a clinical phenomenon that may partially differ in males and females. For example, chronic hyperactivation of the physiological stress response system and heightened cortisol reactivity to a psychosocial stressor have been found in narcissistic males but not in females with NPD (Edelstein et al., 2010; Reinhard et al., 2012). Similarly, sex

differences in volumetric and connectivity of part of networks involved in emotional processing have been found in NPD (Yang et al., 2015). More generally, the neural substrates of different characteristics of the self that are linked to NPD (e.g. self-esteem) (Caligor et al., 2015; Ronningstam, 2017; Sagar and Stoeber, 2009) may exhibit sex differences (Fan et al., 2011; Sylvers et al., 2008). Our results support the importance of continued research on the shared and specific mechanisms underlying NPD between sexes, which may help refine both biologic and psychosocial approaches to treatment and prevention. Our findings are also consistent with gender role theories on affect regulation. These theories suggest that sex differences in emotional process might be partly due to cultural expectations about gender roles. Thus, in response to negative affect, males may display greater levels of impulsivity while females may respond with greater levels of self-focus (Hoertel et al., 2011, 2012a, 2012b, Ingram et al., 1988; Morrow and Nolen-Hoeksema, 1990; Zlotnick et al., 2002). However, because gender role theories on affect regulation could be linked to western gender role norms (Costa et al., 2001), future studies in such assessments conducted in a non-western context would be useful to confirm and extend our findings.

We found that males were more likely to report ‘lack of empathy’ at lower levels of NPD severity than females. Empathy accounts for the naturally occurring subjective experience of similarity between the feelings expressed by self and others without losing sight of whose feelings belong to whom (Decety and Jackson, 2004). Empathy involves both the affective experience of the other person’s actual or inferred emotional state (i.e., affective empathy) and the recognition and understanding of another’s emotional state (i.e., cognitive empathy) (Buffel du Vaure et al., 2017). The basic components of empathy include shared neural representations, mental flexibility, self-awareness, and emotion regulation, and are underpinned by specific neural systems (Decety, 2007; Decety and Jackson, 2004; Warrier et al., 2017). Most studies in social psychology (Decety and Jackson, 2004; Ickes, 2003; Ritter et

al., 2011), although not all (Warrier et al., 2017; Donges et al., 2012), generally questions the alleged female-superiority in empathic understanding and suggests motivational differences between the genders instead (Decety and Jackson, 2004). However, several studies suggest sex differences in the neurobiological underpinnings of empathy and divergence between the sexes in how emotional information is integrated to support decision making processes (Christov-Moore et al., 2014; Marissen et al., 2012). For example, a prior fMRI study suggests sex differences in neural response to infant crying and laughing (Seifritz et al., 2003). Females but not males showed neural deactivation in the anterior cingulate cortex in response to infant crying and laughing, independently of their parental status. In addition, parents showed stronger activation of the amygdala and interconnected limbic structures for crying whereas nonparents showed stronger activation from laughing. These results suggest that the emotion-sharing component may be subjected to personal experience and/or emotion regulation is prepared biologically different in males and females (Decety and Jackson, 2004). Although limited, the experimental research on empathy and narcissism generally indicates a stronger deficit in affective rather than cognitive empathy (Decety and Jackson, 2004). For example, research using self-report questionnaires measuring components of empathy supports that narcissism may be inversely related to cognitive empathy (Watson et al., 1992). In addition, individuals with high levels of narcissism report lower levels of willingness to engage in empathic concern (Davis, 1983). Conversely, narcissistic individuals tend to overestimate their capacity for affective empathy (Ritter et al., 2011). This pattern may indicate that narcissistic individuals have a motivation-based impairment in their cognitive empathic functioning in addition to compromised emotional empathy (Decety, 2007; Decety and Jackson, 2004). Taken together these prior findings and ours, we may hypothesize that although both males and females with high levels of narcissism may be capable of processing affective information (Ames & Kammrath, 2004), males might be more reluctant than females

at similar level of narcissism to engage in empathic processing so as not to lose control or appear vulnerable.

The symptom “being envious” appeared to significantly better discriminate the level of NPD severity in males than in females. Envy is a subjectively unpleasant response to unfavorable social comparisons made with advantaged others in domains of personal relevance (Salovey and Rodin, 1984). Prior research suggests that ventral striatum plays a role in mediating the emotional consequences of social comparison (Dvash et al., 2010; Fliessbach et al., 2007). A prior study (DePriore et al., 2012) explored causal domains of envy and tested predictions about whether it is sex differentiated in nature. Its results suggest that envy is sex-differentiated in ways that correspond to differences in the adaptive problems reliably confronting males and females over evolutionary time. From a research perspective, these results support the importance of continued research on sex differences in biological and psychological mechanisms underlying envy, which may help highlight sex-specific mechanisms underlying NPD.

Although the sex differences found in this study can reflect true group differences, it is important to keep in mind that DIF may also reflect some form of sex bias in diagnostic criteria (Kubarych et al., 2010). We found that 7 out of 9 criteria for NPD were sex invariant, including some symptoms whose prevalence classically differs between males and females in the general population, such as “interpersonally exploitative”, “sense of entitlement”, “grandiose sense of self-importance” and “fantasies of power” (Bylsma et al., 1992; Grijalva et al., 2015; Karterud et al., 2011; Major, 1994; Major et al., 1984; O'Brien et al., 2012). Therefore, our findings caution against a reformulation of NPD criteria ‘lack of empathy’ and ‘being envious’ in the absence of further research.

This study has several limitations. First, the data are cross-sectional and important information on clinical course of NPD (e.g., length of illness, use of psychotherapy) was not

available in NESARC (Kernberg, 2014; Ronningstam, 2014, 2017). Second, assessments for NPD symptoms in NESARC are based on self-reports. Self-reports may induce gender contrast in the way to capture “lack of empathy” and biases leading individuals to assume gender-role stereotypes (Baez et al. 2017). Despite this potential reporting bias, the comparability of our findings to previous factor analytic studies using clinical assessment of NPD (Fossati et al., 2005; Kubarych et al., 2010; Miller et al., 2007) provides support for the validity of our results. Third, NPD symptoms, and in particular “lack of empathy”, were assessed as dichotomous concepts rather than continuous constructs. Growing evidence suggests that the narcissism–empathy link is a complex relationship reflecting fluctuations in empathic functioning within and across narcissistic individuals (Ronningstam et al. 2017). Future studies would benefit in confirming our results while examining NPD symptoms in a finer grain manner. Fourth, we evaluated sex differences in the likelihood of reporting DSM-IV NPD symptoms. It is important to note that there may be also other clinical features that differentiate NPD between males and females (Grijalva et al., 2015). Fifth, information on gender was not available in NESARC. Future studies would benefit in confirming our results while examining gender instead of sex differences. Finally, expression of symptoms in NPD may be partly determined by group norms, cultural acceptability and social condition in which it appears (Grijalva et al., 2015; Karterud et al., 2011). Future studies would benefit in confirming our results while taking account the potential role of sociocultural factors.

Despite these limitations, our results suggest that ‘lack of empathy’ and ‘being envious’ provide substantially different information in males and females. We found that males were more likely than females to endorse ‘lack of empathy’ at lower levels of NPD severity. In addition, the item ‘being envious’ appeared to be significantly more discriminant in terms of severity in males than in females. Although our results may reflect sex-bias in

diagnostic criteria, they are consistent with other recent findings suggesting that NPD could be understood as a clinical phenomenon that may partially differ in males and females.

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Contributors: NH, HP and FL designed the study. HP undertook statistical analyses. NH, HP and PL wrote the first draft of the manuscript. CB, CGL, MR, JPS, CL, RD and FL reviewed the draft. All authors contributed to and have approved the final manuscript.

References

- Ackerman, R.A., Donnellan, M.B., Robins, R.W., 2012. An item response theory analysis of the narcissistic personality inventory. *J. Pers. Assess.* 94(2), 141-155.
- Aggen, S.H., Neale, M.C., Kendler, K.S., 2005. DSM criteria for major depression: evaluating symptom patterns using latent-trait item response models. *Psychol. Med.* 35(4), 475-487.
- Ames, D.R., Kammrath, L.K., 2004. Mind-reading and metacognition: narcissism, not actual competence, predicts self-estimated ability. *J. Nonverbal. Behav.* 28(3), 187-209.
- American Psychiatric Association, 2013. *Diagnostic and Statistical Manual of Mental Disorders (5th ed.)*. American Psychiatric Publishing, Arlington, VA.
- Asparouhov, T., 2005. Sampling weights in latent variable modeling. *Struct. Equ. Modeling.* 12, 411-434.
- Baez, S., Flichtentrei, D., Prats, M., Mastandueno, R., García, A.M., Cetkovich, M., Ibáñez, A., 2017. Men, women...who cares? A population-based study on sex differences and gender roles in empathy and moral cognition. *PLoS One.* 12(6), e0179336.
- Barnett, M., Sharp, K., 2017. Narcissism, gender, and evolutionary theory: the role of private and public self-absorption. *Pers. Individ. Dif.* 104, 326-332.
- Baskin-Sommers, A., Krusemark, E., Ronningstam, E., 2014. Empathy in narcissistic personality disorder: from clinical and empirical perspectives. *Pers. disord.* 5(3), 323.
- Benjamini, Y., Hochberg, Y., 1995. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J. R. Stat. Soc. Ser. B.* 57, 289-300.
- Buffel du Vaure, C., Lemogne, C., Bunge, L., Catu-Pinault, A., Hoertel, N., Ghasarossian, C., Vincens, M.E., Galam, E., Jaury, P., 2017. Promoting empathy among medical students: a two-site randomized controlled study. *J. Psychosom. Res.* In press. doi:10.1016/j.jpsychores.2017.10.008
- Buss, D.M., Chiodo, L.M., 1991. Narcissistic acts in everyday life. *J. Personal.* 59, 179-215.
- Bylsma, W.H., Major, B., 1992. Two routes to eliminating gender differences in personal entitlement: social comparisons and performance evaluations. *Psychol. Women. Q.* 16(2), 193-200.
- Caligor, E., Levy, K.N., Yeomans, F.E., 2015. Narcissistic personality disorder: diagnostic and clinical challenges. *Am. J. Psychiatry.* 172(5), 415-422.
- Carragher, N., Weinstock, L.M., Strong, D., 2013. Psychometric evaluation of the DSM-IV criterion B mania symptoms in an Australian national sample. *Psychol. Med.* 43(2), 433-443.
- Costa, P.T. Jr., Terracciano, A., McCrae, R.R., 2001. Gender differences in personality traits across cultures: robust and surprising findings. *J. Pers. Soc. Psychol.* 81(2), 322-331.
- Christov-Moore, L., Simpson, E.A., Coudé, G., Grigaityte, K., Iacoboni, M., et al., 2014. Empathy: gender effects in brain and behavior. *Neurosci. Biobehav. Rev.* 46(4), 604-627.
- DelPriore, D.J., Hill, S.E., Buss, D.M., 2012. Envy: Functional specificity and sex-differentiated design features. *Pers. Individ. Dif.* 53(3), 317-322.
- Dvash, J., Gilam, G., Ben-Ze'ev, A., Hendler, T., Shamay-Tsoory, S.G., 2010. The envious brain: the neural basis of social comparison. *Hum. Brain. Mapp.* 31(11), 1741-1750.
- Davis, M.H., 1983. Measuring individual differences in empathy: evidence for a multidimensional approach. *J. Pers. Soc. Psychol.* 44(1), 113-126.
- Decety, J., 2007. A social cognitive neuroscience model of human empathy. *Social neuroscience: Integrating biological and psychological explanations of social behavior.* 246, 270.
- Decety, J., Jackson, P.L., 2004. The functional architecture of human empathy. *Behav Cogn Neurosci Rev.* 3(2), 71-100.

- Donges, U.S., Kersting, A., Suslow, T., 2012. Women's greater ability to perceive happy facial emotion automatically: gender differences in affective priming. *PLoS One*. 7(7), e41745.
- Edelstein, R.S., Yim, I.S., Quas, J.A., 2010. Narcissism predicts in men. *J. Res. Pers.* 44(5), 565–572.
- Fan, Y., Wonneberger, C., Enzi, B., de Greck, M., Ulrich, C., Tempelmann, C., Bogerts, B., Doering, S., Northoff, G., 2011. The narcissistic self and its psychological and neural correlates: an exploratory fMRI study. *Psychol. Med.* 41(8), 1641-1650.
- Fliessbach, K., Weber, B., Trautner, P., Dohmen, T., Sunde, U., Elger, C.E., Falk, A., 2007. Social comparison affects reward-related brain activity in the human ventral striatum. *Science*. 318(5854), 1305-1308.
- Fossati, A., Beauchaine, T.P., Grazioli, F., Carretta, I., Cortinovia, F., Maffei, C., 2005. A latent structure analysis of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Narcissistic Personality Disorder criteria. *Compr. Psychiatry*. 46(5), 361-367.
- Foster, J.D., Campbell, W.K., Twenge, J.M., 2003. Individual differences in narcissism: inflated self-views across the lifespan and around the world. *J. Res. Pers.* 37, 469–486.
- Furnham, A., 2006. Personality disorders and intelligence. *J. Ind. Diff.* 27, 42–46.
- Gabbard, G.O., Crisp-Han, H., 2016. The many faces of narcissism. *World Psychiatry*. 15(2), 115-116.
- Grant, B.F., Goldstein, R.B., Chou, S.P., Huang, B., Stinson, F.S., Dawson, D.A., et al., 2009. Sociodemographic and psychopathologic predictors of first incidence of DSM-IV substance use, mood and anxiety disorders: results from the Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions. *Mol. Psychiatry*. 14(11), 1051-1066.
- Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, S.P., Dufour, M.C., Compton, W., et al., 2004a. Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch. Gen. Psychiatry*. 61(8), 807-816.
- Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, S.P., Ruan, W.J., Pickering, R.P., 2004b. Co-occurrence of 12-month alcohol and drug use disorders and personality disorders in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch. Gen. Psychiatry*. 61(4), 361-368.
- Grijalva, E., Newman, D.A., Tay, L., Donnellan, M.B., Harms, P.D., Robins, R.W., et al., 2015. Gender differences in narcissism: a meta-analytic review. *Psychol. Bull.* 141(2), 261-310.
- Grijalva, E., Harms, P.D., Newman, D.A., Gaddis, B.H., Fraley, R.C., 2015. Narcissism and leadership: a meta-analytic review of linear and nonlinear relationships. *Pers. Psychol.* 68(1), 1-47.
- Grilo, C., Becker, D.F., Fehon, D.C., Walker, M.L., 1998. Gender differences in personality disorders in psychiatrically hospitalized adolescents. *J. Youth. Adolesc.* 27, 29-41.
- Hoertel, N., Blanco, C., Peyre, H., Wall, M.M., McMahon, K., Gorwood, P., Lemogne, C., Limosin, F., 2016. Differences in symptom expression between unipolar and bipolar spectrum depression: results from a nationally representative sample using item response theory (IRT). *J. Affect. Disord.* 204, 24-31.
- Hoertel, N., Dubertret, C., Schuster, J.P., Le Strat, Y., 2012a. Sex differences in shoplifting: results from a national sample. *J Nerv Ment Dis.* 200(8), 728-733.
- Hoertel, N., Le Strat, Y., Lavaud, P., Limosin, F., 2012b. Gender effects in bullying: results from a national sample. *Psychiatry Res.* 200(2-3), 921-927.

- Hoertel, N., Le Strat, Y., Schuster, J.P., Limosin, F., 2011. Gender differences in firesetting: results from the national epidemiologic survey on alcohol and related conditions (NESARC). *Psychiatry Res.* 190(2-3), 352-358.
- Hoertel, N., López, S., Peyre, H., Wall, M.M., González-Pinto, A., Limosin, F., Blanco, C., 2015. Are symptom features of depression during pregnancy, the postpartum period and outside the peripartum period distinct? Results from a nationally representative sample using item response theory (IRT). *Depress. Anxiety.* 32, 129-140.
- Hoertel, N., Peyre, H., Wall, M.M., Limosin, F., Blanco, C., 2014. Examining sex differences in DSM-IV borderline personality disorder symptom expression using Item Response Theory (IRT). *J. Psychiatr. Res.* 59, 213-219.
- Harford, T.C., Chen, C.M., Saha, T.D., Smith, S.M., Hasin, D.S., Grant, B.F., 2013. An item response theory analysis of DSM-IV diagnostic criteria for personality disorders: findings from the national epidemiologic survey on alcohol and related conditions. *Personal. Disord.* 4(1), 43-54.
- Ickes, W., 2003. *Everyday mind reading*. New York: Prometheus.
- Ingram, R.E., Cruet, D., Johnson, B.R., Wisnicki, K.S., 1998. Self-focused attention, gender, gender role, and vulnerability to negative affect. *J. Pers. Soc. Psychol.* 55(6), 967-978.
- Kahler, C.W., Strong, D.R., Stuart, G.L., Moore, T.M., Ramsey, S.E., 2003. Item functioning of the alcohol dependence scale in a high-risk sample. *Drug. Alcohol. Depend.* 72(2), 183-192.
- Karterud, S., Øienc, M., Pedersena, G., 2011. Validity aspects of the Diagnostic and Statistical Manual of mental disorders, Fourth Edition, narcissistic personality disorder construct. *Compr. Psychiatry.* 52(5), 517-526.
- Kernberg, O.F., 2014. An overview of the treatment of severe narcissistic pathology. *Int. J. Psychoanal.* 95(5), 865-888.
- Kubarych, T.S., Aggen, S.H., Kendler, K.S., Torgersen, S., Reichborn-Kjennerud, T., Neale, M.C., 2010. Measurement non-invariance of DSM-IV narcissistic personality disorder criteria across age and sex in a population-based sample of Norwegian twins. *Int. J. Methods. Psychiatr. Res.* 19(3), 156-166.
- Lord, F., 1980. *Applications of item response theory to practical testing problems*. Hillsdale, NJ: Erlbaum.
- Luo, Y.L., Cai, H., Song, H.A., 2014. Behavioral genetic study of intrapersonal and interpersonal dimensions of narcissism. *PloS one.* 9(4):e93403.
- Lynam, D.R., Widiger, T.A., 2007. Using a general model of personality to understand sex differences in the personality disorders. *J. Personal. Disord.* 21(6), 583-602.
- Major, B., 1994. From social inequality to personal entitlement: the role of social comparisons, legitimacy appraisals, and group membership. *Adv. Exp. Soc. Psychol.* 26, 293-355.
- Major, B., McFarlin, D.B., Gagnon, D., 1984. Overworked and underpaid: on the nature of gender differences in personal entitlement. *J. Pers. Soc. Psychol.* 47(6), 1399-1412.
- Marissen, M.A., Deen, M.L., Franken, I.H., 2012. Disturbed emotion recognition in patients with narcissistic personality disorder. *Psychiatry Res.* 198(2), 269-273.
- McBride, O., Strong, D.R., Kahler, C.W., 2010. Exploring the role of a nicotine quantity-frequency use criterion in the classification of nicotine dependence and the stability of a nicotine dependence continuum over time. *Nicotine Tob. Res.* 12(3), 207-216.
- Miller, J.D., Campbell, W.K., Piskonis, P.A., 2007. Narcissistic personality disorder: relations with distress and functional impairment. *Compr. Psychiatry.* 48(2), 170-177.
- Millsap, R.E., Yun-Tein, J., 2004. Assessing factorial invariance in ordered-categorical measures. *Multivariate Behav. Res.* 39(3), 479-515.

- Morrow, J., Nolen-Hoeksema, S., 1990. Effects of responses to depression on the remediation of depressive affect. *J. Pers. Soc. Psychol.* 58(3), 519-527.
- Muthén, L.K., Muthén, B.O., 2007. *Mplus: statistical analysis with latent variables-user's guide*. Muthén & Muthén: Los Angeles.
- O'Brien, L.T., Major, B.N., Gilbert, P.N., 2012. Gender differences in entitlement: the role of system-justifying beliefs. *Pers. Psychol.* 34(2), 136-145.
- Paulhus, D.L., Williams, K.M., 2002. The dark triad of personality: narcissism, machiavellianism, and psychopathy. *J. Res. Pers.* 36, 556-563.
- Peyre, H., Hoertel, N., Cortese, S., Acquaviva, E., De Maricourt, P., Limosin, F., et al, 2014. Attention-deficit/hyperactivity disorder symptom expression: a comparison of individual age at onset using item response theory. *J. Clin. Psychiatry.* 75(4), 386-392.
- Reinhard, D.A., Konrath, S.H., Lopez, W.D., Cameron, H.G., 2012. Expensive egos: narcissistic males have higher cortisol. *PLoS One.* 7(1):e30858.
- Richman, J.A., Flaherty, J.A., 1990. Gender differences in narcissistic styles. In E. Plakun (Ed.). *New perspectives on narcissism* (pp. 37-100). Washington, DC: American Psychiatric Association.
- Ritter, K., Dziobek, I., Preißler, S., Rüter, A., Vater, A., Fydrich, T., Lammers, C.H., Heekeren, H.R., Roepke, S., 2011. Lack of empathy in patients with narcissistic personality disorder. *Psychiatry Res.* 187(1), 241-247.
- Rivollier, F., Peyre, H., Hoertel, N., Blanco, C., Limosin, F., Delorme, R., 2015. Sex differences in DSM-IV posttraumatic stress disorder symptoms expression using item response theory: a population-based study. *J. Affect. Disord.* 187, 211-217.
- Ronningstam, E., 2014. Introduction to the special series on "Narcissistic personality disorder--new perspectives on diagnosis and treatment". *Personal. Disord.* 5(4), 419-421.
- Ronningstam, E., 2017. Intersect between self-esteem and emotion regulation in narcissistic personality disorder - implications for alliance building and treatment. *Borderline Personal. Disord. Emot. Dysregul.* 4, 3.
- Rowe, R., Pickles, A., Simonoff, E., Bulik, C.M., Silberg, J.L., 2002. Bulimic symptoms in the Virginia Twin Study of Adolescent Behavioral Development: correlates, comorbidity, and genetics. *Biol. Psychiatry.* 51(2),172-182.
- Ruan, W.J., Goldstein, R.B., Chou, S.P., Smith, S.M., Saha, T.D., Pickering, R.P., et al, 2008. The alcohol use disorder and associated disabilities interview schedule-IV (AUDADIS-IV): reliability of new psychiatric diagnostic modules and risk factors in a general population sample. *Drug Alcohol Depend.* 92(1-3), 27-36.
- Russ, E., Shedler, J., Bradley, R., Westen, D., 2008. Refining the construct of narcissistic personality disorder: diagnostic criteria and subtypes. *Am. J. Psychiatry.* 165(11), 1473-1481.
- Sagar, S.S., Stoeber, J., 2009. Perfectionism, fear of failure, and affective responses to success and failure: the central role of fear of experiencing shame and embarrassment. *J. Sport. Exerc. Psychol.* 31(5), 602-627.
- Saha, T.D., Compton, W.M., Chou, S.P., Smith, S., Ruan, W.J., Huang, B., et al, 2012. Analyses related to the development of DSM-5 criteria for substance use related disorders: 1. Toward amphetamine, cocaine and prescription drug use disorder continua using Item Response Theory. *Drug Alcohol Depend.* 122(1-2), 38-46.
- Saha, T.D., Compton, W.M., Pulay, A.J., Stinson, F.S., Ruan, W.J., Smith, S.M., Grant, B.F., 2010. Dimensionality of DSM-IV nicotine dependence in a national sample: an item response theory application. *Drug Alcohol Depend.* 108(1-2),21-28.
- Salovey, P., Rodin, J., 1984. Some antecedents and consequences of social-comparison jealousy. *J. Pers. Soc. Psychol.* 47, 780-792.

- Scott, N.W., Fayers, P.M., Aaronson, N.K., Bottomley, A., de Graeff, A., Groenvold, M., et al, 2010. Differential item functioning (DIF) analyses of health-related quality of life instruments using logistic regression. *Health Qual. Life Outcomes*. 8, 81.
- Seifritz, E., Esposito, F., Neuhoﬀ, J.G., Lüthi, A., Mustovic, H., Dammann, G., von Bardeleben, U., Radue, E.W., Cirillo, S., Tedeschi, G., Di Salle, F., 2003. Differential sex-independent amygdala response to infant crying and laughing in parents versus nonparents. *Biol. Psychiatry*. 54, 1367-1375.
- Shmulewitz, D., Keyes, K.M., Wall, M.M., Aharonovich, E., Aivadyan, C., Greenstein, E., et al, 2011. Nicotine dependence, abuse and craving: dimensionality in an Israeli sample. *Addiction*. 106(9), 1675-1686.
- Simon, G.E., Von Korﬀ, M., 2006. Medical co-morbidity and validity of DSM-IV depression criteria. *Psychol. Med*. 36(1), 27-36.
- Steinberg, L., Thissen, D., 2006. Using effect sizes for research reporting: examples using item response theory to analyze differential item functioning. *Psychol. Methods*. 11(4), 402-415.
- Stinson, F.S., Dawson, D.A., Goldstein, R.B., Chou, S.P., Huang, B., Smith, S.M., et al, 2008. Prevalence, correlates, disability, and comorbidity of DSM-IV narcissistic personality disorder: results from the wave 2 national epidemiologic survey on alcohol and related conditions. *J. Clin. Psychiatry*. 69(7), 1033-1045.
- Strong, D.R., Kahler, C.W., Colby, S.M., Griesler, P.C., Kandel, D., 2009. Linking measures of adolescent nicotine dependence to a common latent continuum. *Drug Alcohol Depend*. 99(1-3), 296-308.
- Sylvers, P., Brubaker, N., Alden, S.A., Brennan, P.A., Lilienfeld, S.O., 2008. Differential endophenotypic markers of narcissistic and antisocial personality features: a psychophysiological investigation. *J. Res. Pers*. 42, 1260–1270.
- Torgersen, S., Kringle, E., Cramer, V., 2001. The prevalence of personality disorders in a community sample. *Arch. Gen. Psychiatry*. 58(6), 590-596.
- Trull, T.J., Jahng, S., Tomko, R.L., Wood, P.K., Sher, K.J., 2010. Revised NESARC personality disorder diagnoses: gender, prevalence, and comorbidity with substance dependence disorders. *J. Pers. Disord*. 24(4), 412-426.
- Tschanz, B.T., Morf, C.C., Turner, C.W., 1998. Gender differences in the structure of narcissism: a multi-sample analysis of the narcissistic personality inventory. *Sex Roles*. 38, 863–870.
- Uebelacker, L.A., Strong, D., Weinstock, L.M., Miller, I.W., 2009. Use of item response theory to understand differential functioning of DSM-IV major depression symptoms by race, ethnicity and gender. *Psychol. Med* 39(4), 591-601.
- Uebelacker, L.A., Strong, D., Weinstock, L.M., Miller, I.W., 2010. Likelihood of suicidality at varying levels of depression severity: a re-analysis of NESARC data. *Suicide Life Threat. Behav*. 40(6), 620-627.
- Warrier, V., Grasby, K.L., Uzefovsky, F., Toro, R., Smith, P., Chakrabarti, B., Khadake, J., Mawbey-Adamson, E., Litterman, N., Hottenga, J.J., Lubke, G., Boomsma, D.I., Martin, N.G., Hatemi, P.K., Medland, S.E., Hinds, D.A., Bourgeron, T., Baron-Cohen, S., 2017. Genome-wide meta-analysis of cognitive empathy: heritability, and correlates with sex, neuropsychiatric conditions and cognition. *Mol Psychiatry*. In press. doi:10.1038/mp.2017.122.
- Watson, P.J., Little, T., Sawrie, S.M., Biderman, M.D., 1992. Measures of the narcissistic personality: complexity of relationships with self-esteem and empathy. *J. Pers. Disord*. 6(4), 434-449.
- Weinstock, L.M., Strong, D., Uebelacker, L.A., Miller, I.W., 2009. Differential item functioning of DSM-IV depressive symptoms in individuals with a history of mania

- versus those without: an item response theory analysis. *Bipolar Disord.* 11(3), 289-297.
- Weinstock, L.M., Strong, D., Uebelacker, L.A., Miller, I.W., 2010. DSM-IV depressive symptom expression among individuals with a history of hypomania: a comparison to those with or without a history of mania. *J. Psychiatr. Res.* 44(14), 979-985.
- Weiss, D., Davison, M.L., 1981. Test Theory and Methods. *Annu. Rev. Psychol.* 32(1), 629-658.
- Widiger, T.A., Lowe, J.R., 2008. A dimensional model of personality disorder: proposal for DSM-V. *Psychiatr. Clin. North. Am.* 31(3), 363-378.
- Wright, A.G., Lukowitsky, M.R., Pincus, A.L., Conroy, D.E., 2010. The higher order factor structure and gender invariance of the Pathological Narcissism Inventory. *Assessment.* 17(4), 467-483.
- Yang, W., Cun, L., Du, X., Yang, J., Wang, Y., Wei, D., et al, 2015. Gender differences in brain structure and resting-state functional connectivity related to narcissistic personality. *Sci. Rep.* 5, 10924.
- Zlotnick, C., Rothschild, L., Zimmerman, M., 2002. The role of gender in the clinical presentation of patients with borderline personality disorder. *J. Pers. Disord.* 16(3), 277-282.
- Zumbo, B., 1999. A handbook on the theory and methods of differential item functioning (DIF): logistic regression modeling as a unitary framework for binary and likert-type (ordinal) item scores.

Table 1. Prevalence of DSM-IV-TR symptoms of Narcissistic Personality Disorder (NPD) by sex in the NESARC.

DSM-IV symptoms	Females (N=19975)		Males (N=14501)		Chi-2 (df=1)	p-value
	%		%			
Grandiose sense of self-importance	4.8		4.1		4.8	0.030
Preoccupied with fantasies	1.0		1.4		7.2	0.009
Believes he/she is special/unique	1.9		2.8		16.3	< 0.001
Requires excessive admiration	1.7		1.9		1.3	0.261
Sense of entitlement	4.0		6.8		87.3	< 0.001
Interpersonally exploitative	2.1		3.4		28.6	< 0.001
Lack of empathy	4.6		9.0		169.5	< 0.001
Being envious	4.0		3.2		10.9	0.001
Arrogant/haughty behaviors/attitudes	0.9		0.9		0.2	0.642
Diagnosis of narcissistic personality disorder	4.8		7.7		79.3	< 0.001

Percentages are weighted values.

p-values were adjusted for multiple testing using the Benjamini-Hochberg procedure.

p-values in bold are statistically significant ($p < 0.05$).

Table 2. Differential item functioning (DIF) of DSM-IV Narcissistic Personality Disorder (NPD) symptoms by sex in the full NESARC sample.

DSM-IV symptoms	Females (N=19975)		Males (N=14501)		DIFFTEST a			DIFFTEST b				
	a	Rank a	Rank b	a	Rank a	Rank b	χ^2 Difference	<i>p</i> Difference	DIFa	χ^2 Difference	<i>p</i> Difference	DIFb
Grandiose sense of self-importance	0.96	2	2.40	1.08	2	2.53	3.9	0.049	-0.12	34.5	<0.001	-0.12
Preoccupied with fantasies	1.25	5	2.98	1.22	3	3.01	0.1	0.705	0.02	0.0	0.850	-0.03
Believes he/she is special/unique	0.96	1	2.98	0.96	1	2.94	0.2	0.625	0.00	0.8	0.369	0.04
Requires excessive admiration	1.32	7	2.65	1.49	9	2.65	2.7	0.098	-0.17	4.7	0.030	0.00
Sense of entitlement	1.44	9	2.13	1.45	8	1.98	1.1	0.296	-0.01	17.6	<0.001	0.16
Interpersonally exploitative	1.36	8	2.52	1.42	7	2.41	1.0	0.309	-0.06	3.1	0.079	0.12
Lack of empathy	1.22	4	2.17	1.25	5	1.88	1.3	0.250	-0.03	58.2	<0.001	0.29
Being envious	1.06	3	2.41	1.34	6	2.47	8.6	0.003	-0.28	50.7	<0.001	-0.07
Arrogant/haughty behaviors/attitudes	1.28	6	3.02	1.23	4	3.20	0.0	0.847	0.05	4.6	0.032	-0.18

Note: a = discrimination parameter estimate, b = severity parameter estimate.

p-values were adjusted for multiple testing using the Benjamini-Hochberg procedure.

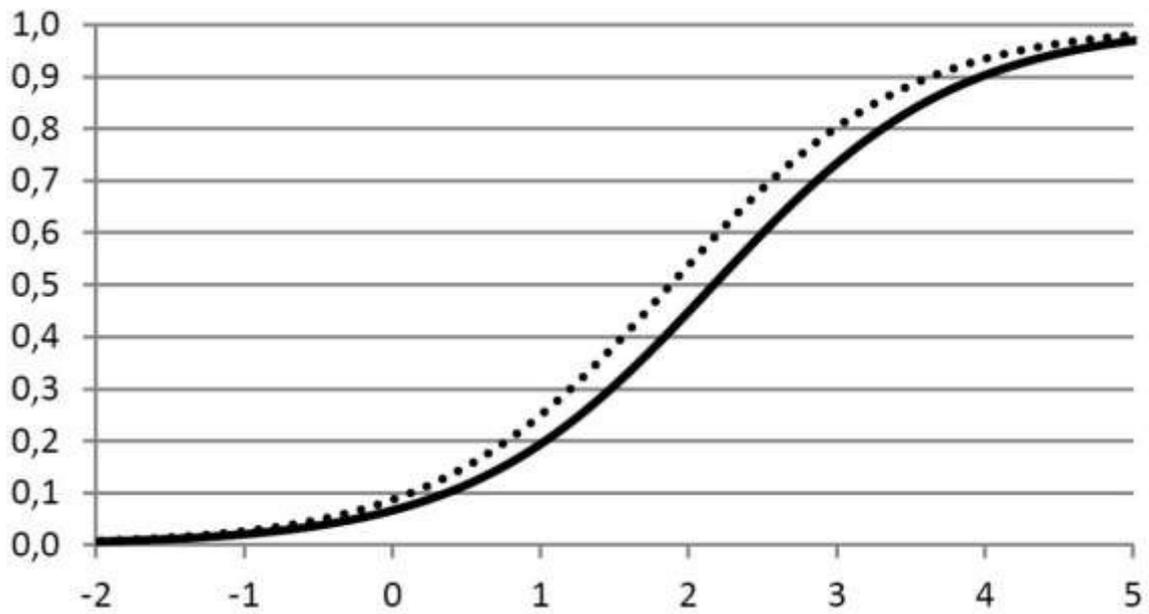
Values for chi square tests in bold are statistically (*p*<0.05) and clinically (DIF>0.25) significant.

Sampling weights and design effects of the NESARC were taken into account.

DIFFTEST a = comparing both models with the factor loading respectively free and fixed for the corresponding item.

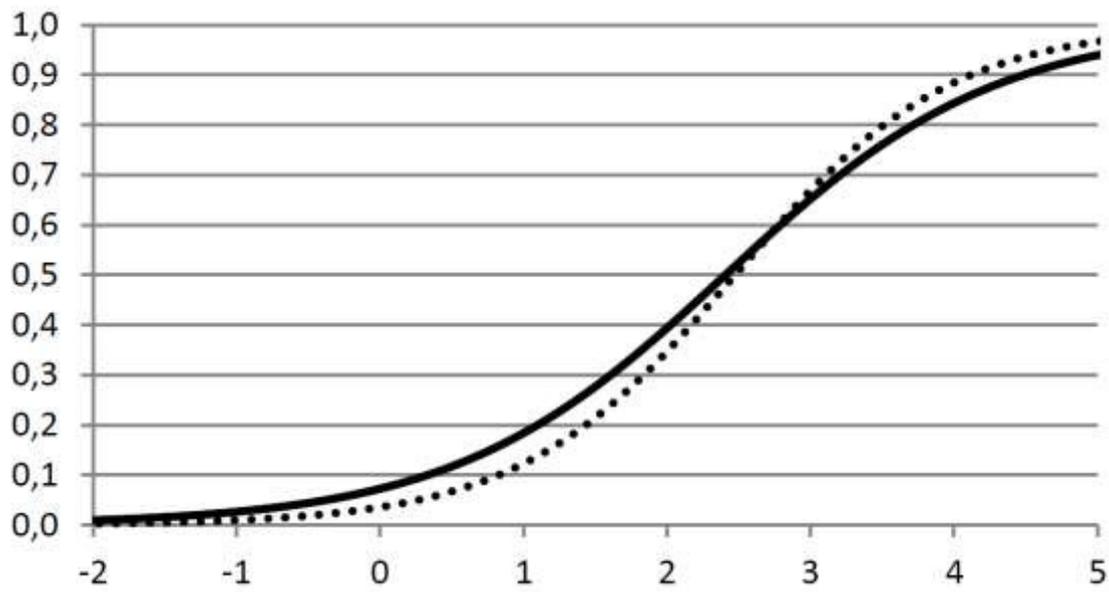
DIFFTEST b = comparing both models with the threshold respectively free and fixed for the corresponding item.

Figure 1. Differences between females (—) and males (---) in the probability of endorsing the item 'Lack of empathy' across levels of narcissistic personality disorder severity.



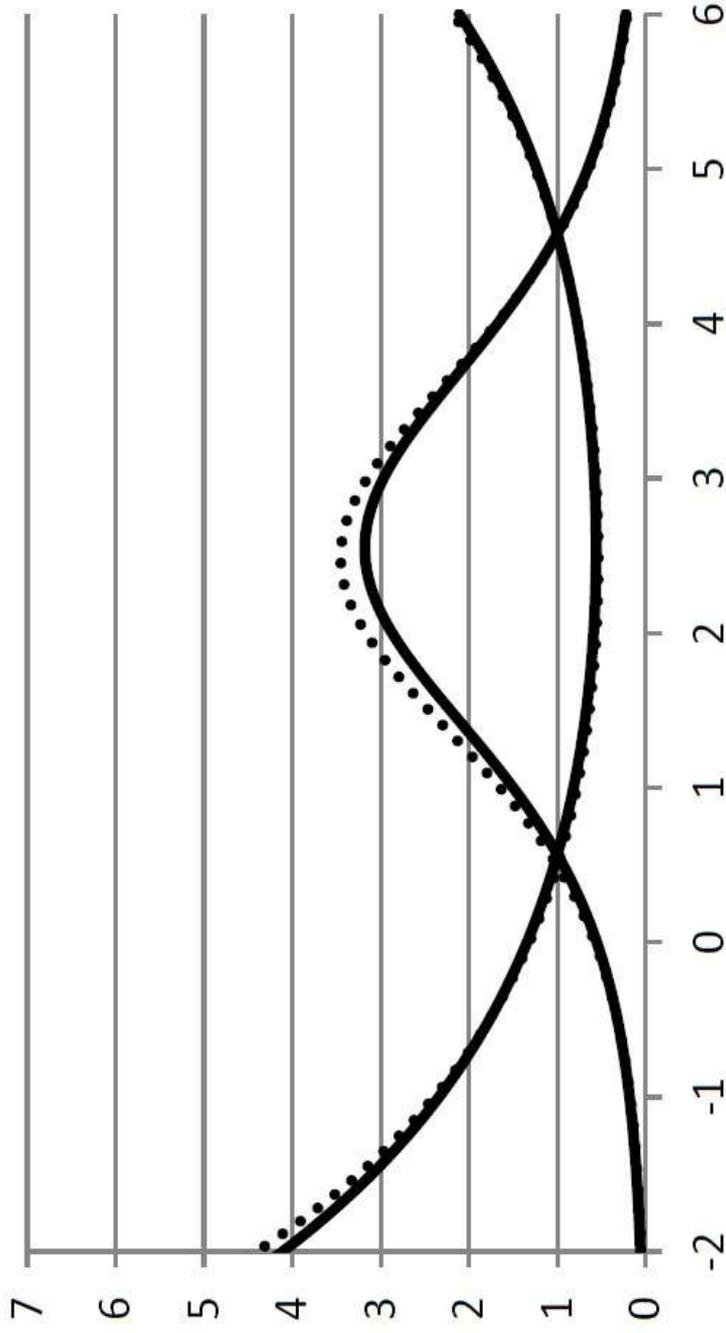
Accepted manu

Figure 2. Differences between females (—) and males (---) in the probability of endorsing the item 'Being envious' across levels of narcissistic personality disorder severity.



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Figure 3. Test information function (TIF) and its standard error of measures (SEM) for narcissistic personality disorder (NPD) symptom expression in females (—) and males (---).



Highlights

- We examined sex differences in narcissistic personality disorder (NPD) symptoms.
- There were significant sex differences for 2 out of the 9 DSM-IV NPD symptoms.
- Men were more likely to endorse 'lack of empathy' at lower levels of NPD severity.
- 'Being envious' was a better indicator of NPD severity in men than in women.
- NPD may be underpinned by shared and sex-specific mechanisms.