Personality subtyping and bulimia nervosa: psychopathological and genetic correlates

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Abstract:

Background. There is empirical evidence suggesting that individuals with bulimia nervosa vary considerably in terms of psychiatric co-morbidity and personality functioning. In this study, latent profile analysis was used to attempt to identify clusters of bulimic subjects based on psychiatric co-morbidity and personality.

Method. A total of 178 women with bulimia nervosa or a subclinical variant of bulimia nervosa completed a series of self-report inventories of co-morbid psychopathology and personality, and also provided a buccal smear sample for genetic analyses.

Results. Three clusters of bulimic women were identified: an affective-perfectionistic cluster, an impulsive cluster, and a low co-morbid psychopathology cluster. The clusters showed expected differences on external validation tests with both personality and eating-disorder measures. The impulsive cluster showed the highest elevations on dissocial behavior and the lowest scores on compulsivity, while the affective-perfectionistic cluster showed the highest levels of eating-disorder symptoms. The clusters did not differ on genetic variations of the serotonin transporter gene.

Conclusions. This study corroborates previous findings suggesting that the bulimia nervosa diagnostic category is comprised of three classes of individuals based on co-morbid psychopathology and personality. These differences may have significant etiological and treatment implications.

Keywords: personality subtyping | bulimia nervosa

Article:

Introduction

There has been an increasing interest in efforts to identify subtypes of bulimia nervosa (BN) based on symptom patterns (Stice & Agras, 1999; Grilo et al. 2001) and personality traits (Strober, 1983; Goldner et al. 1999; Westen & Harnden-Fischer, 2001). Studies using symptom patterns for subtyping have found two types: one group high in dietary restraint and a second group high in dietary restraint plus negative affect (Stice & Agras, 1999; Grilo et al. 2001). Cluster analytical studies of the personality traits in eating-disordered subjects have consistently revealed three clusters : an impulsive and emotionally dysregulated cluster; an anxious, compulsive cluster; and a relatively high functioning cluster (Strober, 1983; Goldner et al. 1999; Westen & Harnden-Fischer, 2001).

The presence of such heterogeneity within the BN diagnostic construct may have significant implications for research and treatment. Westen & Harnden-Fischer (2001) provide data to suggest that personality-based clusters in the eating disorders are more predictive of level of functioning and clinical course than specific eating disorder diagnoses. However, such patterned personality-based variation may also have significance in terms of etiology. For example, recent research examining the association of specific genetic variants and behavioral traits within the BN diagnostic category suggests that particular candidate genes, such as the transcriptional control region of the serotonin transporter gene (5-HTTLPR) may be associated with impulsivity and compulsivity (Steiger et al. in press a, b). These findings imply that the short allele of the 5-HTTLPR may be linked to impulsivity in bulimic subjects, which may imply different etiologic pathways for subtypes.

In the present study, five research centers collaborated to study the patterns of co-morbid psychopathology in the BN diagnostic category. We employed latent profile analysis (LPA) to determine the optimal number of clusters in the BN construct based on measures of comorbid psychopathology often seen in BN, including depression, anxiety, substance use disorders, and behavioral features of impulsivity, self-destructive behavior and perfectionism (Wonderlich & Mitchell, 1997). This approach offers two advantages over previous research. First, unlike traditional clustering methods that rely on ad-hoc distance measures, LPA uses a general probability model that allows for unequal variances in each cluster, use of variables with mixed scale types, and formal statistical procedures for determining the optimal number of clusters. Second, the LPA in the present study was based on measures of co-morbid psychopathology, which are clinically relevant and common in bulimic individuals. Using these measures of psychiatric co-morbidity to form subtypes, we were able to determine if the same pattern of clusters emerged that has been found in previous personality-based cluster analyses. Furthermore, in the present study we compared the clusters on personality trait variables to determine if psychiatric comorbidity-based clustering showed specific associations to underlying personality dimensions. We also included subject's status on the 5-HTTLPR polymorphism in the LPA to use genetic variation to enhance subtype classification. On the basis of previous personality based cluster analyses, we predicted the presence of an impulsive and affectively dysregulated cluster, a compulsive-anxious cluster, and a third cluster which would be lower in co-morbid psychopathology. We anticipated that the impulsive and affectively dysregulated cluster would be most likely to display the s allele of the 5-HTTLPR.

METHOD

Participants

In total, 204 females were entered in the study, but genotyping was possible on only 178 subjects. These 178 subjects ranged in age from 18 to 57 years (mean=25.56, S.D.=8.88 years). Participants were recruited through advertisements in eating-disorder clinics and surrounding communities at all five sites (Madison, WI; Minneapolis, MN; Fargo, ND; Chicago, IL; Columbia, MO). Inclusion criteria were female gender, age range of 18–65 years, and the presence of binge eating and purging behavior. A total of 133 (74.7%) of 178 the participants in the present analyses were single and 168 (94.4%) had received at least some education beyond high school. The majority (93.3%) of the subjects were Caucasian. Over half (59.6%) were full-time students, 50 (28.1%) were at least part-time wage earners, four (2.2%) were homemakers, and 18 (10.1%) were unemployed or reported other employment. Individuals with current psychotic disturbances, organic brain syndromes, or the inability to read were excluded from the study.

There were 119 subjects (66.9%) who met DSM-IV diagnostic criteria for current BNpurging type. Five subjects (2.8%) met criteria for current BN-non-purging type. Thirty-seven subjects (20.8%) reported substantial bulimic symptoms, but did not meet diagnostic threshold for BN and were categorized as subclinical BN. Seventeen subjects (9.6%) displayed purging behavior, but their binges did not meet objective binge-eating criteria and were also included in the category of subclinical BN. The mean number of binge episodes in the last 30 days reported by these subclinical participants was 7.3 (S.D.=7.6, range=0–28), while the mean number of purge episodes was 15.0 (S.D.=16.1, range=0–80). Given contradictory findings about the distinction between subclinical and full threshold BN, with some studies finding negligible differences (Fairburn & Harrison, 2003) and others finding significant differences (Grilo et al. 2003), we elected to include subclinical cases to see if these cases differed in cluster membership.

Measures

The Structured Clinical Interview for DSM-IV, Patient Edition (SCID-P) The SCID-P is a widely used semi-structured interview to assess Axis I disorders (First et al. 1995). In this study, only the SCID eating disorder module was administered in a telephone interview to ensure that the subject met inclusion criteria.

Dimensional Assessment of Personality
Pathology – Basic Questionnaire (DAPP-BQ)

The DAPP is a 290-item self-report questionnaire with 18 scales (i.e. Submissiveness, Cognitive Dysregulation, Identity Problems, Affective Lability, Stimulus Seeking, Compulsivity, Restricted Expression, Callousness, Oppositionality, Intimacy Problems, Rejection, Anxiousness, Conduct Problems, Suspiciousness, Social Avoidance, Narcissism, Insecure Attachment, and Self Harm) (Livesley et al. 1992). Coefficient alphas in the present study ranged from 0.81 (conduct problems) to 0.95 (selfharm) for the scales.\

Frost Multi-Dimensional Perfectionism Scale (MPS)

The MPS is a 35-item self-report questionnaire designed to assess major dimensions of perfectionism (Frost et al. 1990). Coefficient alpha in the present study for the total perfectionism score was 0.93.

Impulsive Behavior Scale (IBS)

The IBS is a 25-item self-report questionnaire which assesses the presence of different impulsive and self-destructive behaviors (Rossotto et al. 1994). The total score gives a global level of impulsive and self-destructive behaviors. Coefficient alpha in the present study was 0.87.

Eating Disorders Examination

Questionnaire – Version 4 (EDEQ-4) The EDEQ-4 is a 36-item self-report measure adapted from the EDE interview (Fairburn & Beglin, 1994). In the present study, coefficient alphas ranged from 0.72 to 0.83 for the subscales (i.e. weight concern, shape concern, eating concern, restraint).

Michigan Assessment Screening Test/Alcohol-Drug (MAST/AD)

The MAST/AD is a 25-item self-report measure designed to assess the severity of drug and alcohol problems. It has been shown to correlate substantially with a variety of other alcohol and drug screening measures (Westermeyer et al. 2002). In the present study, coefficient alpha was 0.75.

Inventory for Depressive Symptomatology – Self Report (IDS-SR)

The IDS-SR is a 30-item, depression specific, symptom severity rating scale (Rush et al. 1986). The IDS is a valid and reliable measure (Rush et al. 1986) and demonstrated a coefficient alpha of 0.90 in the present study.

Spielberger Stait-Trait Anxiety Inventory (STAI/SSAI)

In the present study, we only used the trait version (STAI). This instrument consists of 20 statements that assess how people ‘generally feel ’ (Spielberger, 1983). Coefficient alpha was 0.95 in the present study.

Maudsley Obsessive–Compulsive Inventory (MOCI)

The MOCI is a 30-item true–false, self-report questionnaire that assesses overt rituals and their related obsessions (Hodgson &Rachman, 1977). Coefficient alpha was 0.85 in the present study.

Procedure

Diagnostic Screening

Interested participants were given a brief telephone screen that included questions from the SCID-P. Participants who met current DSM-IV diagnostic criteria for BN or subclinical BN, as defined above, were invited to take part in the study. Participants were not ruled out on the basis of any history of AN. Eligible subjects provided informed consent, completed the questionnaires, and provided a buccal smear for the genetic analysis. Participants were paid $50 for their time.

Genetic analysis

Participants donated buccal cells via cheek swabs, using standard procedures (Buccal Swab DNA Extraction Kit, Epicentre Technologies, Madison, WI, USA). Polymerase chain reaction (PCR) amplification of 5-HTTLPR was performed on DNA extracted from buccal cells. Primers for 5-HTTLPR were 5k-GGCGTTGC CGCTCTGAATTGC and 5k-GAGGGACT GAGCTGGACAACCCAC. PCR was performed in a final volume of 50 ml containing approximately 100 ng genomic DNA template, 0.05 U/ml Taq DNA polymerase (RedTaq, Sigma, St. Louis, MO, USA), 0.5 mM of each primer, 50 mM KCl, 10 mM Tris–HCl (pH 8.3), 1.5 mM MgCl2, and 300 mM betaine. Following an initial denaturation at 95 xC for 2 min, amplification was carried out for 35 cycles consisting of the following steps: 95 xC for 1 min, 58 xC for 1 min, 72 xC for 1 min. This was followed by an extension step of 72 xC for 5 min. PCR products were resolved on a 2% agarose gel and stained with ethidium bromide.

Genotype distributions in this sample conform to the Hardy–Weinberg equilibrium [x2(2)=0.337, p=N.S.]. Additionally, we compared the percentages of these three genotypes (s/s, s/l, and l/l) in our sample to the expected general population percentages based on the previous findings of Lesch et al. (1996). Lesch et al. estimated that the percentages of the genotypes in the general population were as follows, s/s=19%, s/l=49%, and l/l=32%. Subjects in our bulimic sample were less likely to display the l/l genotype and more likely to display the s/s genotype (s/s=42%, s/l=47%, and l/l=11%; x2=31.75, p=0.001).

Statistical analysis

A LPA based on a generalized linear model with multinomial distribution was performed to identify latent clusters of subjects within the sample. Indicator variables included measures of impulsivity (IBS total score), perfectionism (Frost total score), depression (IDS-SR total score), anxiety (STAI total score), substance abuse (MAST/AD), and obsessive–compulsive symptoms (MOCI). Genotype information (i.e. presence of s allele versus no s allele) was also included as an indicator variable based on its putative link to impulsive features. Site was included as a covariate in the LPA to minimize the influences of between-site differences. Parameters were estimated using maximum likelihood. The determination of the number of clusters was based jointly on minimization of the Bayesian information criteria (BIC) parsimony index (Sclove, 1987) and minimization of cross-classification probabilities. Assignment of cluster membership was based on Bayesian probabilities. Analysis was performed using Latent Gold version 3.0 software (Vermunt & Magidson, 2000).

To investigate the stability of the LPA analysis, a bootstrap procedure was performed. One hundred consecutive random samples of 95% of the original 178 participants were drawn. For each bootstrap sample, a separate LPA was performed. Stability was evaluated in terms of (1) the number of clusters identified, and (2) a comparison of individual cluster membership between the original and bootstrapped samples.

A multivariate analysis of variance (MANCOVA) was performed to characterize clusters on continuous LPA indicators, controlling for site. Univariate tests with Tukey's HSD post-hoc comparisons were performed after obtaining a significant multivariate effect. Clusters were compared on 5-HTTLPR classification using x2. For external validation MANCOVAs were also performed comparing clusters on DAPP and EDE scales controlling for age. Based upon significant multivariate effects, univariate analyses of covariance were then performed on individual scales with covariate adjusted post-hoc comparisons corrected for multiple comparisons using the Bonferroni procedure.

RESULTS

Results of the LPA

LPA of the full sample revealed a clear three cluster solution which was confirmed by all 100 bootstrap samples. The overall rate of individual classification discrepancy between the original and bootstrap procedures was less than 1.9%.

The psychopathology scales that were entered into the LPA and the differences between the clusters on these scales are presented in Table 1. Cluster 2 (affective-perfectionistic) was significantly differentiated from the other two clusters on measures of perfectionism, obsessive–compulsive symptoms, trait anxiety and depression. On the other hand, cluster 3 (impulsive) was characterized by the highest scores on measures of impulsive/self-destructive behavior and substance abuse. Cluster 1 (low co-morbidity) showed a consistent pattern of the lowest scores on all of the variables in the LPA. As can be seen in Table 1, cluster 3 (impulsive) showed higher rates of the s allele than the other clusters, but this was not a significant difference.

External validation of the LPA clusters on demographics

There were no significant differences among the clusters in the subjects' marital status, education level, ethnicity, or family income. However, there were significant differences among the clusters in age, with cluster 3 (impulsive) older on average (mean=29.69, S.D.=11.06 years) than cluster 1 (low co-morbidity) (mean=25.49, S.D.=8.96 years) or cluster 2 (affective-perfectionistic) (mean=22.81, S.D.=5.49 years) ($F=6.81$, $df=2, 175$, $p=0.001$). Subject age was consequently included as a statistical covariate in the remaining external validation comparisons.

External validation of the LPA with the DAPP

In order to reduce the number of dependent variables in our external validation analyses, we conducted principal component factor analysis with an oblimin rotation on the 18 scales of the DAPP. This analysis produced a four-factor solution with a pattern of factor loading identical to that in previous definitive studies in the development of the DAPP (Livesley et al. 1998). The four higher-order factors were: Emotional Dysregulation (i.e. unstable affective responding,

interpersonal problems), Dissocial Behavior (i.e. lacking regard for others), Inhibition (i.e. deriving little enjoyment from intimate relationships), and Compulsivity (i.e. passivity and absence of oppositional behavior) (Livesley et al. 1998). Factor scores were created based on unity weighting of all standardized variables which loaded at least 0.40 on the given factor. Correlations between these higher order factors and LPA indicators ranged from 0.089 (MAST/AD) to 0.748 (STAI) for Emotional Dysregulation, 0.211 (STAI) to 0.343 (IBS) for Dissocial Behavior, x0.001 (MAST/AD) to 0.261 (STAI) for Inhibition, and x0.423 (IBS) to 0.162 (Frost) for Compulsivity.

Table 1. Comparisons between LPA clusters on psychopathology measures included in the LPA

	Cluster 1 (low co morbidity) (n=90)	**Cluster 2 (affective perfectionistic) (n=52)**	**Cluster 3 (impulsive) (n=36)**
IDS (depression)			
Mean	21·11[a]	40·79[c]	30·92[b]
(S.D.)	(8·27)	9·65)	(10·61)
IBS (impulsive behavior)			
Mean	49·41[a]	56·15[b]	73·42[c]
(S.D.)	(11·09)	(12·69)	(12·39)
MADST (alcohol/drug)			
Mean	5·06[a]	6·2[a]	23·81[b]
(S.D.)	(2·52)	(2·92)	(16·06)
STAI (Trait anxiety)			
Mean	46·72[a]	66·04[c]	53·33[b]
(S.D.)	(9·19)	(6·33)	(11·44)
MOCI (obsessive–compulsive)			
Mean	5·08[a]	13·00[c]	7·06[b]
(S.D.)	(2·51)	(5·43)	(3·99)
Frost (perfectionism)			
Mean	110·17[a]	139·37[c]	117·56[b]
(S.D.)	(16·9)	(12·55)	(18·54)
5-HTTLPR (s allele)			
n	80	46	34
(%)	(88·9)	(88·5)	(94·4)

Different superscript letters across columns represent significant differences between clusters.

A one-way MANCOVA (clusters 1 v. 2 v. 3) was conducted on the four higher-order DAPP scales. The multivariate comparison between the clusters was highly significant (Wilks' lambda= 0.542, F=15.320, df=8, 342, p=0.0001), as were the univariate F tests on each of the higher order scales (F=5.62–39.27, df=2, 174, p= 0.004–0.0001). As shown in Table 2, post-hoc tests revealed differences on the DAPP which supported the LPA results, with cluster 3 (impulsive) scoring higher than the other clusters on the Dissocial Behavior scale and lower than the other clusters on Compulsivity (see Table 2). Cluster 2 (affective-perfectionistic) and cluster 3 (impulsive) scored higher than cluster 1 (low psychopathology) on Emotional Dysregulation. Cluster 2 (affective-perfectionistic) scored higher than cluster 1 (low psychopathology) on Inhibitedness.

Table 2. Comparisons between LPA clusters on dimensional assessment of personality pathology higher-order scales

	Cluster 1 (low comorbidity) (n=90)	Cluster 2 (affective perfectionistic) (n=52)	Cluster 3 (impulsive) (n=36)
Emotional Dysregulation			
Mean	459·52[a]	542·28[b]	511·92[b]
(S.D.)	(57·49)	(44·34)	(61·03)
Dissocial Behavior			
Mean	313·39[a]	335·73[b]	348·64[c]
(S.D.)	(39·20)	(38·72)	(31·45)
Inhibitedness			
Mean	51·14[a]	63·29[b]	55·97[ab]
(S.D.)	(20·66)	(22·08)	(23·85)
Compulsivity			
Mean	-109·57[a]	-109·62[a]	-128·53[b]
(S.D.)	(25·33)	(25·68)	(20·15)

Different superscript letters across columns represent significant differences between clusters.

External validation of the LPA with the EDEQ-4

In order to compare the clusters on level of eating dysfunction, a one-way MANCOVA (clusters 1 v. 2 v. 3) was performed on the four scales of the EDEQ-4. The results of this analysis revealed a highly significant difference among the clusters (Wilks' lambda=0.852, F=3.5, df= 8, 340, p=0.001) and the univariate analyses revealed significant differences on each of the EDEQ-4 scales (F=5.8–9.85, df=2, 173, p= 0.003–0.0001). As can be seen in Table 3, there was a pattern with cluster 2 (affective perfectionistic) scoring higher than the other two clusters on shape concern and weight concern. On the eating concerns and restraint scales, cluster 2 (affective-perfectionistic) scored higher than cluster 1 (low co-morbidity), but was not differentiated from cluster 3 (impulsive).

Table 3. Comparisons between LPA clusters on Scales of the EDEQ-4

	Cluster 1 (low comorbidity) (n=90)	Cluster 2 (anxious perfectionistic) (n=52)	Cluster 3 (impulsive) (n=36)
Restraint			
Mean	3·75[a]	4·43[b]	3·85[ab]
(S.D.)	(1·26)	(1·01)	(1·27)
Eating Concern			
Mean	3·26[a]	4·12[b]	3·71[ab]
(S.D.)	(1·24)	(1·05)	(1·50)
Shape Concern			
Mean	4·43[a]	5·29[b]	4·50[a]
(S.D.)	(1·02)	(0·72)	(1·46)
Weight Concern			
Mean	4·10[a]	4·99[b]	4·04[a]
(S.D.)	(1·03)	(1·00)	(1·54)

Different superscripts across columns represent significant differences between clusters.

Comparison of clusters on eating-disorder diagnosis

In order to compare the clusters on severity of bulimic symptomatology, they were compared on lifetime histories of full syndrome versus subclinical BN. There were no significant differences among clusters in percentage of subjects in each cluster who met full criteria for BN [cluster 1=72.2%, cluster 2=78.8%, cluster 3= 88.9%; x2(2)=4.173, p=0.12]. There were, however, significant differences between clusters in lifetime history of anorexia nervosa [cluster 1= 15.6%, cluster 2=36.5%, cluster 3=33.3%; x2(2)=9.231, p=0.010].

DISCUSSION

The identification of three psychopathology-based clusters of BN subjects (i.e. affective perfectionistic, impulsive and low psychopathology) supports previous cluster analytical studies (Strober, 1983; Goldner et al. 1999; Westen & Harnden-Fischer, 2001). The present study was the first to identify this pattern of clusters using an objective technique to determine the optimal number of clusters (i.e. LPA) and to use measures of co-morbid psychopathology for the cluster identification, rather than personality scales. Also, our bootstrapping procedures suggested the classification of subjects was highly reliable. Collectively, the present findings, along with previous reports, suggest that the BN diagnostic construct is a heterogeneous category which can be meaningfully organized in terms of behavioral traits including affective disturbance, perfectionism, substance use, compulsivity, and impulsivity. We agree with Westen & Harnden-Fischer (2001) who have emphasized that the identification of within-diagnostic category variation is critical for both theory development and treatment, as collapsing heterogeneous groups within a larger diagnostic category cancels out ‘patterned within group variability ’ (p. 560) which may have substantial clinical implications.

The impulsive cluster of bulimic subjects in the present study (cluster 3) was characterized primarily by elevated impulsive behaviors, self destructive behaviors and drug and alcohol abuse. This is consistent with past studies of borderline personality disorder in BN, as well as the descriptive construct of multi-impulsive BN (Wonderlich & Swift, 1990; Fichter et al. 1994). Although, recent studies have suggested that this impulsive subgroup may display genetic and biologic indications of hyposerotonergic neurotransmission (Steiger et al. in press a, b) we did not find a significant association to the 5-HTTLPR polymorphism, although the percentages were in the hypothesized direction. This may suggest that the clustering pattern identified in this study is associated with non-genetic or genetic influences other than the 5-HTTLPR. However, methodological issues may have influenced the present findings. The fact that our particular sample was characterized by a preponderance of s alleles when compared to the general population percentages estimated by Lesch et al. (1996), or other samples of BN subjects (Steiger et al. in press a) may have limited the likelihood of finding an association with behavioral traits. A recent meta-analysis suggests the s/s genotype may be particularly common in BN subjects (Brown, J. & Joiner, T., unpublished observations).

Cluster 2 (affective-perfectionistic) was distinguished by high levels of affective disturbance, obsessionality, compulsivity, and perfectionism, all features that are often ascribed to restricting AN subjects (Kaye et al. 1991; Bardone et al. 2000). This cluster displayed the highest levels of eating-disorder psychopathology on the EDEQ- 4. It appears that this cluster of bulimic individuals displays the most prototypic and severe eating disorder, which most clearly resembles

anorexia nervosa. Such phenotypic resemblance to anorexia nervosa may help account for the recent report of a subset of BN subjects who show low levels of novelty seeking crossing over to an anorexia nervosa diagnosis in longitudinal studies (Tozzi et al. in press).

Cluster 1 (low co-morbidity) displayed the lowest levels of eating-disorder psychopathology on the EDEQ-4. This cluster, which was the most common in this study was primarily distinguished by low levels of all indicators of co-morbid psychopathology, personality pathology, and eating-disorder psychopathology. The fact that this low pathology cluster is identified across numerous studies supports early clinical speculation that a subset of individuals with serious bulimic symptoms shows minimal evidence of other psychiatric disturbance (Johnson & Connors, 1987).

As classification researchers continue to devise schemes for categorizing eating-disordered individuals, behavioral trait and personality variables may be useful to consider. Recent latent class analyses of eating-disordered individuals have identified 4–6 classes of eating disorder symptomatology (Bulik et al. 2000; Keel et al. 2004). The present study underscores that even in the presence of relative homogeneity of eating-disorder symptoms, there is additional variability associated with psychiatric co-morbidity and personality features. The integration of these symptom-based and behavioral trait-based models may enhance future classification studies of individuals with eating disorders.

While the present study contributes to this developing literature, and brings several strengths in terms of its large sample size, assessment of personality with a reliable instrument, and inclusion of a genetic variable, it is also limited methodologically by the reliance on self-report measures of psychopathology and personality. Future studies should attempt to replicate these findings with interview-based assessments. Furthermore, the absence of a normal or psychopathology control group precludes inferences about the absolute levels of the various behavioral indicators in this study, and their relationship to normality. Also, LPA is influenced by the measures entered into the analysis and we cannot prove that three clusters definitively exist in BN or that an individual subject necessarily exists in a particular cluster.

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DECLARATION OF INTEREST

None.

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