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Symptom variability in depersonalization-derealization disorder: A latent profile analysis

Short running title: Symptom variability in DDD

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Abstract

Objective: Depersonalization-derealization disorder (DDD) is characterized by diverse symptomatology overlapping with anxiety and dissociative disorders, but the sources of this variability are poorly understood. This study aims to determine whether symptom heterogeneity is attributable to the presence of latent subgroups.

Method: We applied latent profile analysis (LPA) to psychometric measures of anxiety, depersonalization-derealization, and dissociation in 303 DDD patients.

Results: The analysis yielded evidence for five discrete subgroups: three of varying severity levels and two moderate-to-severe classes characterized by differential dissociative symptoms. The five classes reliably differed on several non-dissociative symptoms, comorbidities, and factors precipitating their diagnosis but did not significantly differ in other symptoms including anxiety.

Conclusion: These results suggest the presence of three distinct DDD subtypes in the upper severity range that are distinguished by differential expression of detachment and compartmentalization symptoms. Further elucidation of these subtypes has potential implications for the aetiology, mechanisms, and treatment of DDD.

Keywords: dissociation; anxiety; heterogeneity; depersonalization derealization disorder; latent profile analysis

1. Introduction

Depersonalization denotes “a state in which the sense of self and the quality of subjective first-person experience are oddly altered” (Medford, 2012, p. 3). Pronounced disconnections from the self are defined as depersonalization, while disconnections from external reality are defined as derealization (American Psychiatric Association, 2013). Although transient experiences of depersonalization and/or derealization are relatively common in response to trauma, fatigue, or substance use (Hunter, Sierra & David, 2004), a chronic state of either symptom may lead to a diagnosis of *Depersonalization-Derealization Disorder* (DDD). Within the *Diagnostic and Statistical Manual* of the American Psychiatric Association (DSM-5; American Psychiatric Association, 2013), DDD is classified as one of three dissociative disorders and falls under the category of dissociative disorders in the ICD-11 (World Health Organization, 2018).

With a prevalence of 1-2% in the general population (Hunter, Sierra, & David, 2004; Michal et al., 2009; Michal et al., 2011) and onset most commonly in adolescence or early adulthood (Baker et al., 2003), DDD comprises a diverse array of symptoms including physiological or emotional numbing, sensory impairments, feelings of disembodiment, distorted experience of time, feeling as if one is in a dream, visual perceptual distortions, and an unreal or absent sense of self (Simeon & Abugel, 2006). Those affected by this condition are not deemed to have psychosis and have intact reality testing (American Psychiatric Association, 2013), yet there is a striking change in the nature of their personal experience. Symptoms of depersonalization and derealization may be observed in other psychiatric disorders including anxiety disorders such as posttraumatic stress disorder (PTSD) and panic disorder, as well as depression and schizophrenia (Hunter, Sierra, & David, 2004).

DDD is characterized by heterogeneity comprising diverse symptomatology that overlaps with both anxiety and other dissociative disorders. DDD patients frequently experience cognitive symptoms of increased arousal paired with subjective deficits in attention and concentration, as seen in anxiety disorders (Wells & Matthews, 1994; see also Hunter, Phillips, Chalder, Sierra & David, 2003; Hunter, Salkovskis & David, 2014). Case series conducted by Simeon, Knutelska, Nelson and Guralnik (2003), Baker et al. (2003), and Michal et al. (2016), report high levels of co-morbid anxiety in people with DDD. Moreover, DDD differs from other dissociative disorders, with disturbances of memory observed less frequently (e.g., Lyssenko et al., 2018). Hunter et al. further proposed that DDD is most frequently triggered by one's response to situations that provoke anxiety (Hunter et al., 2003). This symptom overlap and high comorbidity of DDD with anxiety disorders (Sierra, Medford, Wyatt & David, 2012) indicates the intrinsic link between DDD and anxiety.

A recent meta-analysis of dissociative symptoms in 19 psychiatric disorders (Lyssenko et al., 2018) leads to questions about the categorization of DDD as a dissociative disorder. In particular, general dissociative symptoms, as indexed by mean *Dissociative Experiences Scale* (DES; Carlson and Putnam, 1993) scores, were lower in patients with DDD than those diagnosed with functional neurological disorder, borderline personality disorder, PTSD, dissociative identity disorder and other dissociative disorders (as defined by the "DSM-5 main category," p. 39). This suggests that the symptom profile of DDD does not reliably encompass the full spectrum of dissociative symptoms (Lyssenko et al., 2018). Factor analyses of the *Cambridge Depersonalization Scale* (CDS; Sierra and Berrios, 2000) and the DES-II (Carlson and Putnam, 1993) similarly point to symptom clusters including amnesia, absorption and imaginative involvement, emotional numbing and alienation from surroundings that are only weakly to

moderately related to one another (Sierra, Baker, Medford, & David, 2005; Carlson et al., 1991). These variable symptom profiles are perhaps encapsulated in the distinction between *detachment* and *compartmentalization* symptoms (Holmes et al., 2005; Brown, 2006), where the authors highlight that although ‘dissociation’ is often used as if a unitary phenomenon, there are distinct and qualitatively different types within this broad definition and a clearer terminology will aid both research and treatment. They propose that ‘detachment’ is defined by a subjective sense of separation as typified by experiences of depersonalization and derealization, whereas ‘compartmentalization’ refers to a dissociative inability to have deliberate control over actions or processes and includes dissociative amnesia, fugue and functional neurological symptoms (e.g. nonepileptic seizures) (Brown, 2006; Holmes et al., 2005). In this way, the use of the overall mean DES score combines qualitatively different types of dissociation and can reduce clarity of diagnosis. Lower DES scores in DDD (Lyssenko et al., 2018) thus are plausibly attributed to fewer ‘compartmentalization’ symptoms in this population than in other dissociative disorders and germane conditions.

A more refined understanding of variable symptomatology within DDD may be developed by evaluating the extent to which this patient population is comprised of discrete subgroups of individuals with differing levels of anxiety, detachment, and compartmentalization symptoms. Typological analytic approaches to heterogeneity within PTSD has reliably yielded evidence for a dissociative subtype (Lanius et al., 2010; Steuwe, Lanius & Frewen, 2012; Lanius, Brand, Vermetten, Frewen & Spiegel, 2012; Wolf et al., 2012; Blevins, Weathers & Witte, 2014), that is now recognized in the DSM-5 (American Psychiatric Association, 2013). This subgroup is characterized by higher levels of depersonalization and derealization symptoms, an increased likelihood of comorbid Axis I disorders, and more reports of childhood abuse and neglect (Wolf

et al., 2012; Steuwe, Lanius & Frewen, 2012) with clinical implications for long-term prognosis and treatment. Applying this analytic orientation to DDD might plausibly lend similar insights into variability in the expression of this condition and inform understanding of differential etiologies and responsiveness to different treatment regimens in DDD subgroups.

The aim of this paper was to better characterize the heterogeneous symptomatology of DDD by evaluating the extent to which this condition includes discrete subgroups. Toward this end, we applied latent profile analysis (LPA), a latent variable modeling technique for partitioning multivariate data into latent classes (McCutcheon, 1987; Vermunt & Magidson, 2002), to the anxiety and dissociative symptom profiles of DDD patients. Although the analyses were data driven, we expected to identify two or more distinct latent classes characterized by differentially elevated anxiety, detachment, or compartmentalization symptoms.

2. Materials & Methods

2.1 Participants

The data were obtained from a database of patients with depersonalization-derealization disorder (DDD) collected during the years 1999-2019 ($N=658$) in the Depersonalization Research Unit at the Institute of Psychiatry, Psychology and Neuroscience, King's College London (Baker et al., 2003; Sierra et al., 2012). Patients in this cohort of consecutive eligible cases were referred to the research unit for diagnostic purposes (initial cases), or were seen in an NHS (National Health Service) clinic for DDD (later cases), or contacted the research unit expressing an interest in participating in research on DDD. For those not seen in person, a telephone assessment including the Present State Examination depersonalization/derealization items was conducted to determine diagnostic status.

After removing (patient) controls ($n = 48$) and repeat patients who attended the clinic at two separate time points ($n = 23$), this sample was comprised of 587 patients. For inclusion in the present analyses, DDD patients had to meet one of the following diagnostic criteria: “*Present State Examination* (PSE; Wing et al., 1967) score ≥ 2 on the depersonalization/derealization items (“Over the last two weeks, how often have you been bothered by the presence of: a) Your surroundings feeling detached or unreal, as if there were a veil between you and the outside world [*derealization*]; b) Out of the blue, you feel strange, as if you were not real or as if you were cut off from the world” [*depersonalization*]; scored from 0 [“not at all] to 3 [“nearly every day”] for both items); DSM diagnosis of DDD (DSM-IV, 1994; DSM-5, 2013); or DDD diagnosis confirmed by a specialist psychiatric clinician following a 1-2 hour clinical interview including the PSE depersonalization/derealization criteria, with any differential diagnoses made during this clinical assessment.” Applying these inclusion criteria left $N = 335$ patients. Additional exclusion criteria included: missing data for more than 5 of the 29 questions on the *Cambridge Depersonalization Scale* (CDS; Sierra and Berrios, 2000) and/or for more than 3 of the 9 indicator variables in the Latent Profile Analysis (LPA; see below), resulting in a final sample of 303 patients. Data were collected as part of a clinical audit and all patients provided written informed consent for their data to be used for research purposes.

2.2 Measures

2.2.1 Medical and Psychiatric History Questionnaire

A detailed questionnaire was designed by the research team for the purposes of audit (Baker et al, 2003). This asked participants to give information about their personal history and history of DDD including questions about potential triggers for onset, pattern of onset, course of

their DDD and fluctuations in severity, as well as other psychiatric symptoms and diagnoses and medical conditions.

2.2.2 Beck Anxiety Inventory (BAI)

The BAI is a 21-item self-report anxiety measure (Beck et al., 1988). Respondents rate how much they have been bothered by specific symptoms in the past week using a 4-point Likert scale (0 [not at all] to 3 [severely]). Scores range from 0-63, with higher scores reflecting more severe anxiety (0-7 = minimal; 8-15 = mild; 16-25 = moderate; 26-63 = severe; Carney et al., 2011). The scale displayed good internal consistency (Cronbach's $\alpha = .92$).

2.2.3 Cambridge Depersonalization Scale (CDS)

The CDS (Sierra and Berrios, 2000) is a 29-item self-administered questionnaire measuring trait depersonalization and derealization. Respondents rate the frequency (0-4) and duration (0-6) of different experiences in the preceding six months. Frequency and duration scores are summed across all items (0-10) with CDS total scores ranging from 0-290. The cut-off score associated with a clinical diagnosis of DDD in 80% of cases is 70 (Sierra and Berrios, 2000). Scores were also calculated for four subscales: emotional numbing (6 items; $\alpha = .85$), anomalous body experience (9 items; $\alpha = .87$), anomalous subjective recall (5 items; $\alpha = .73$), and alienation from surroundings (4 items; $\alpha = .75$) (Sierra et al., 2005).

2.2.4 Cambridge Depersonalization Scale – State Scale (CDS)

A state DDD scale was also developed by Sierra and Berrios (Baker, Hunter, Lawrence & David, 2007). This scale consists of 22 items of Depersonalization and Derealization to which participants rate the percentage severity experienced 'right now' on a visual analogue scale (0% to 100%). Scores are summed to calculate an overall percentage mean. The scale displayed good internal consistency (Cronbach's $\alpha = .93$).

2.2.5 Dissociative Experiences Scale (DES)

The DES-II (Carlson and Putnam, 1993) is a 28-item self-report measure of dissociative experiences using an 11-point scale (0% [never] to 100% [always]). Mean scores above 30 indicate severe levels of dissociation (Carlson et al., 1993). Mean scores were calculated for three subscales: depersonalization-derealization (6 items; $\alpha = .71$), amnesia (8 items; $\alpha = .82$), and absorption and imaginative involvement (9 items; $\alpha = .78$) (Carlson et al., 1991).

2.3 Statistical Analyses

2.3.1 Data Pre-Processing

Data were approximately normally distributed except the CDS ‘alienation from surroundings’ and DES ‘amnesia’ subscales, which displayed distribution normality after a log transformation. Missing data for the 9 indicator variables included in the LPA (BAI, four CDS subscales, three DES subscales, and CDS state) were found for 0.3%-6.6% of cases. Little’s MCAR test was non-significant, $\chi^2(64) = 66.40$, $p = .39$, and therefore we assume the data were missing at random. Expectation-maximisation was used to estimate missing data for these 9 variables.

2.3.2 Latent Profile Analysis

The LPA was conducted on the 303 cases using Mplus Version 7.3 (Muthén and Muthén, 1998-2012) using nine indicator variables (BAI, four CDS subscales, three DES subscales, and CDS state). To determine the optimal number of classes, solutions were examined beginning with a 2-class solution until adding more classes was no longer justified. Class adjudication was performed with the Akaike information criterion (AIC; Akaike, 1973), the Bayesian information criterion (BIC; Schwarz, 1978), and the sample size-adjusted Bayesian information criterion (SSABIC; Sclove, 1987), for which lower values reflect superior fit, and the Bootstrap

Likelihood Ratio Test (BLRT; McLachlan and Peel, 2000), for which a significant value indicates superior fit relative to the $k-1$ model. Previous research has shown that the BIC and BLRT are the best performing indices in class identification (Nylund et al., 2007) and thus these indices were prioritized. The BLRT appears to be more prone to class-overestimation than the BIC and thus the latter was selected *a priori* as the primary index for model selection. We also computed Entropy for each model, which provides a measure of the level of separation among the classes, and for which values > 0.80 indicate that the classes are highly discriminating from one another (Muthén & Muthén, 2007).

2.3.3 Inferential Statistics

After determining the optimal class solution in the LPA, we performed one-way between-groups ANOVAs to evaluate class differences on the 9 LPA indicator variables followed by *post hoc* Tukey HSD tests. The latent classes were subsequently compared using Pearson's chi-square tests examining the main effects of class on 21 other variables of interest comprising three categories: (1) *Symptoms* (panic attack, OCD persistent thoughts, hallucinations, fainting attacks, OCD compulsive behaviour, recurrent headaches/migraines); (2) *Precipitating factors* (substance related, psychological related, situational related, trauma related, social related, physical related; and (3) *Current comorbidities* (major depression, panic disorder, anxiety, OCD, agoraphobia, schizophrenia, drug abuse, alcohol abuse, bipolar disorder). All significant main effects were followed up with 2x2 chi-square tests. When the expected cell count was below 5, Fisher's exact tests were used. Eta squared, Hedge's g , and ϕ were computed as effect sizes measures for ANOVAs, Tukey tests, and chi-squared/Fisher's exact tests. These analyses were conducted using SPSS Version 23 (IBM Corp, 2015).

3. Results

3.1 Patient demographics

Patients were predominantly males (57.4%) and within the age range of 15-89 with an average age of 34.5 (SD = 12.44). 46.2% were single, 12.2% married, 3.9% with a partner, 2.6% separated/divorced, 1.7% widowed, 0.7% other, and 32.7% did not report their marital status. Current work status indicated 35% in employment, 17.2% unemployed, 8.9% students, 3.3% retired, and 35.6% did not report their current work status.

3.2 Latent profile analysis

3.2.1 Determination of number of latent classes

The best fitting model, as indicated by the BIC, was the five-class solution (see **Table 1** for model comparisons). This model had the lowest BIC and an entropy value that was stable with the four- and six- class solutions. Although the six-class solution had a lower AIC value, and a significant BLRT value, the BIC was lower for the five-class model and thus this model was selected as the optimal model.

3.2.2 Class Characteristics

The symptom profiles of the five classes are presented in **Figure 1**. Class 1 (26%; *Low severity*) was characterized by moderate anxiety but lower scores across all other measures whereas Class 2 (30%; *Moderate severity*) displayed a flat profile of moderate scores across scales. Class 3 (11%; *High dissociation*) was characterized by moderate CDS subscale scores, but high DES scores whereas Class 4 (22%; *High depersonalization*) displayed the converse pattern: higher CDS subscale scores but more moderate DES subscale scores. Finally, class 5 (12%; *High severity*) was characterized by high scores across measures. Overall, there is some variability in anxiety scores (BAI), but this variable did not discriminate among the classes very well.

The five classes did not reliably differ on demographic variables (**Table 2**) although there was a suggestive tendency for the Low Severity and High Severity classes to report the oldest and youngest ages of symptom onset, respectively. Sample counts and proportions of patients in each class according to symptom severity are presented in the supplementary material (Table S1). 43% of patients in the High Severity class met criteria for severe anxiety whereas only ~25% of patients in the remaining classes met this criterion. Eighty percent or more of patients scored above 70 on the CDS in all classes except the Low severity class. Finally, 90% or more of patients in the High Dissociation and High Severity classes displayed severe dissociation; by contrast, just over 50% of patients in the High Depersonalization class, and fewer than 10% in the Low and Moderate Severity classes met this criterion. Cumulatively, these results suggest that the High Dissociation and High Severity classes specifically experienced the most severe dissociation, as measured by the DES. Further, the High Depersonalization and High Severity classes were the only two classes to have all members scoring above 70 on the CDS, exhibiting the highest depersonalization-specific scores, with the High severity class additionally experiencing the most severe anxiety.

Table 1.

Fit indices for the LPA on anxiety, depersonalization-derealization and dissociative symptoms in DDD patients (N=303).

Model	AIC	BIC	SSABIC	BLRT	Entropy
2 classes	17685.45	17789.44	17700.63	915.50*	.90
3 classes	17483.05	17624.17	17503.66	222.40*	.86
4 classes	17398.65	17576.91	17424.68	104.40*	.84
5 classes	17351.80	17567.19	17383.25	66.86*	.84
6 classes	17322.17	17574.70	17359.04	49.63*	.84

Note. AIC = Akaike information criterion; BIC = Bayesian information criterion; SSABIC = sample size-adjusted BIC; BLRT = bootstrap likelihood ratio test. Optimal model in bold. * $p < .001$

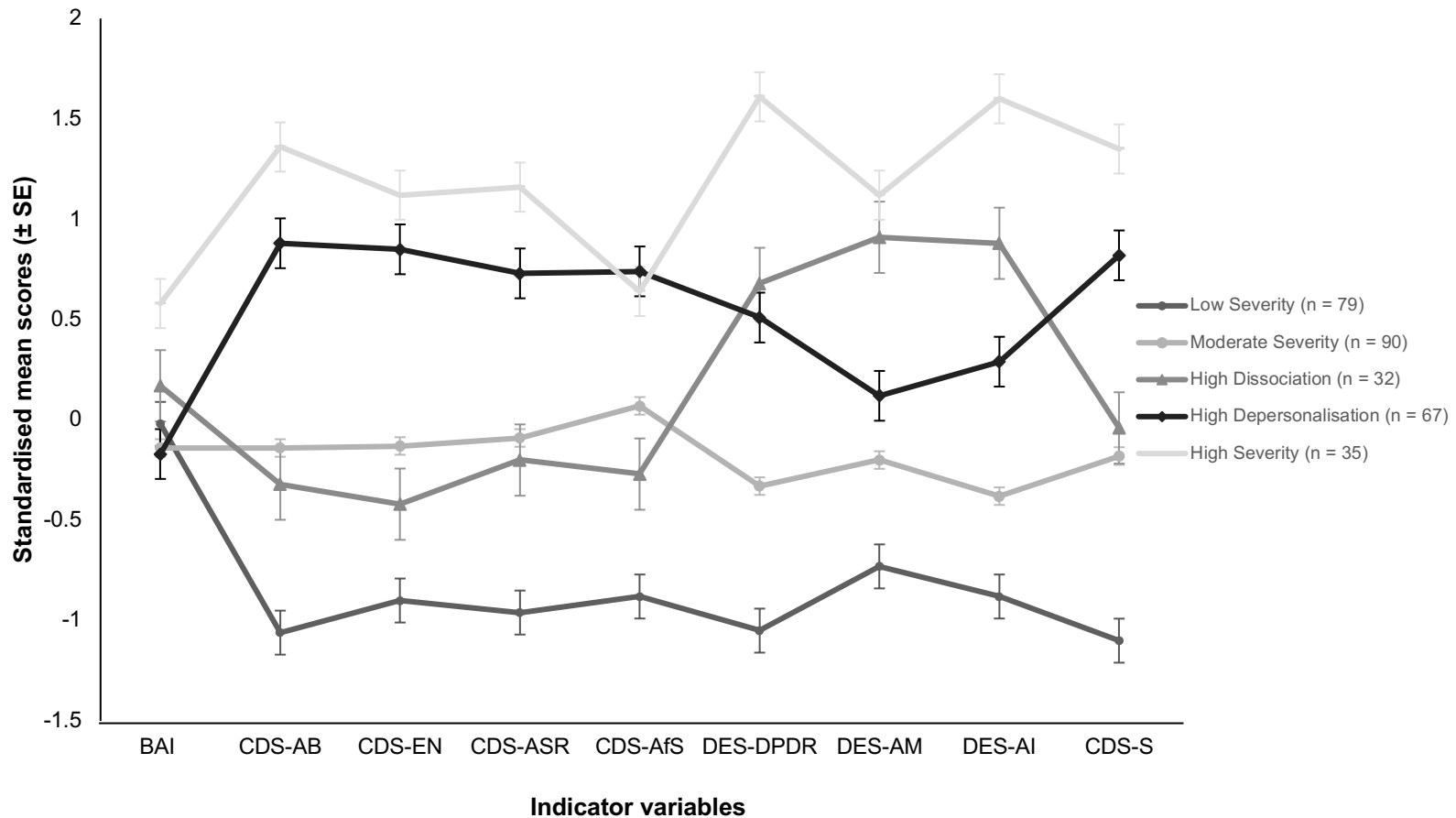


Figure 1. Standardized mean scores on the 9 indicator variables included in the LPA as a function of latent class. BAI = Beck Anxiety Inventory; CDS = Cambridge Depersonalization Scale; DES = Dissociative Experiences Scale; CDS-AB = CDS anomalous body experience; CDS-EN = CDS emotional numbing; CDS-ASR = CDS anomalous subjective recall; CDS-AfS = CDS alienation from surroundings; DES-DPDR = DES depersonalization-derealization; DES-AM = DES amnesia; DES-AI = DES absorption and imaginative involvement; CDS-S = CDS state. Scores were standardized to allow for comparison among indicator variables.

3.3. Class characteristics across LPA indicator variables

3.3.1 BAI

There was a significant main effect of Class on BAI scores (see **Table 3**). The High severity class displayed significantly higher scores than both the Moderate severity ($p = .002$, $g = .68$) and the High depersonalization ($p = .002$, $g = .78$) classes, with a trend towards higher scores than the Low severity class ($p = .022$, $g = .59$). There were no other significant class differences (all $ps > .40$, all $gs < .41$). These results suggest that the classes were relatively comparable except the High severity class, which was characterized by elevated BAI scores.

3.3.2 CDS

There were significant main effects of Class on all CDS subscales. All classes significantly differed on the AB subscale with large, albeit variable, effect sizes ($ps < .001$, g range: 0.78 – 4.77) except the Moderate severity and High dissociation classes ($p = .48$, $g = 0.33$). All classes significantly differed on the EN subscale with large effects ($ps < .01$, g range 0.80 – 3.24) except the Moderate severity and High dissociation classes ($p = .23$, $g = 0.43$) as well as the High depersonalization and High severity classes ($p = .34$, $g = 0.35$). All classes significantly differed on the ASR subscale with large effects ($ps < .001$, g range: 1.10 – 3.73) except the Moderate severity and the High dissociation classes ($p = .93$, $g = 0.16$) although there was a borderline nonsignificant difference between the High depersonalization and the High severity classes ($p = .03$, $g = 0.53$). All classes significantly differed on the AfS subscale with moderate to large effects ($ps < .005$, g range: 0.58 – 2.06) except the Moderate severity and the High dissociation classes ($p = .24$, $g = 0.37$) as well as the High depersonalization and the High severity classes ($p = .97$, $g = 0.33$). All classes significantly differed on the CDS-S with large effects ($ps < .001$, g range: 1.35 – 4.78) except the Moderate severity and the High dissociation classes ($p = .72$, $g = 0.23$). These results suggest that the classes exhibited considerable

Table 2.
Demographic information as a function of latent class.

Variable	Low Severity (<i>n</i> = 79)	Moderate Severity (<i>n</i> = 90)	High Dissociation (<i>n</i> = 32)	High Depersonalization (<i>n</i> = 67)	High Severity (<i>n</i> = 35)	<i>F</i> (<i>df</i>)	<i>p</i>	η^2
	<i>M</i> (<i>SD</i>) [<i>n</i>]	<i>M</i> (<i>SD</i>) [<i>n</i>]	<i>M</i> (<i>SD</i>) [<i>n</i>]	<i>M</i> (<i>SD</i>) [<i>n</i>]	<i>M</i> (<i>SD</i>) [<i>n</i>]			
Age	37.03 (12.57) 78	34.10 (12.63) 90	33.86 (13.07) 29	33.34 (12.29) 64	32.89 (11.26) 35	1.133 (4, 295)	.34	.015
Age of onset	24.41 (12.41) 74	20.66 (8.88) 82	21.05 (9.95) 29	20.84 (8.74) 55	18.41 (8.87) 27	2.398 (4, 266)	.051	.035
	% (<i>n</i>) [<i>n</i>]	% (<i>n</i>) [<i>n</i>]	% (<i>n</i>) [<i>n</i>]	% (<i>n</i>) [<i>n</i>]	% (<i>n</i>) [<i>n</i>]	χ^2 (<i>N</i>)	<i>p</i>	Φ
Gender (% male)	59% (47) [79]	56% (50) [90]	56% (18) [32]	55% (36) [65]	66% (23) [35]	4.293 (174)	.802	.12
Education (% university)	57% (39) [69]	62% (51) [82]	59% (16) [27]	54% (29) [54]	69% (18) [26]	12.71 (153)	.544	.22
Relationship status (% single)	63% (35) [56]	68% (47) [69]	67% (10) [15]	70% (28) [40]	83% (20) [24]	26.71 (140)	.197	.36

Table 3.
Anxiety, depersonalization and dissociation symptoms [*M* and (*SD*)] in DDD patients as a function of latent class.

Variable	Low Severity (<i>n</i> = 79)	Moderate Severity (<i>n</i> = 90)	High Dissociation (<i>n</i> = 32)	High Depersonalization (<i>n</i> = 67)	High Severity (<i>n</i> = 35)	<i>F</i> (4, 298)	<i>p</i>	η^2
BAI	19.99 (11.46)	18.55 (12.53) ^a	22.21 (10.08)	18.19 (10.44) ^b	27.21 (13.60) ^{a,b}	4.32	.002	.06
CDS-AB	13.74 (10.13) ^{a,b,c,d}	34.62 (13.24) ^{a,c,d}	30.41 (10.90) ^{b,c,d}	57.57 (13.96) ^{c,d}	68.51 (14.13) ^d	170.83	<.001	.70
CDS-EN	9.89 (9.73) ^{a,b,c,d}	23.06 (11.51) ^{a,c,d}	18.13 (11.58) ^{b,c,d}	39.63 (13.04) ^c	44.11 (12.27) ^d	88.30	<.001	.54
CDS-ASR	8.19 (5.92) ^{a,b,c,d}	18.56 (8.55) ^{a,c,d}	17.19 (8.39) ^{b,c,d}	28.28 (10.01) ^c	33.37 (8.35) ^d	81.26	<.001	.52
CDS-AfS	1.27 (.19) ^{a,b,c,d}	1.44 (.15) ^{a,c,d}	1.38 (.19) ^{b,c,d}	1.57 (.06) ^c	1.55 (.06) ^d	45.91	<.001	.38
DES-DPDR	13.41 (9.62) ^{a,b,c,d}	28.68 (10.99) ^{a,b,c,d}	49.84 (11.57) ^{b,d}	46.24 (11.81) ^{c,d}	69.24 (11.74) ^d	200.51	<.001	.73
DES-AM	.38 (.39) ^{a,b,c,d}	.66 (.41) ^{a,b,d}	1.25 (.24) ^{b,c}	.83 (.48) ^{c,d}	1.36 (.45) ^d	47.64	<.001	.39
DES-AI	13.99 (9.30) ^{a,b,c,d}	22.67 (10.31) ^{a,b,c}	44.99 (11.55) ^{b,c,d}	34.67 (11.44) ^{c,d}	57.84 (11.85) ^d	134.19	<.001	.64
CDS-S	19.58 (11.54) ^{a,b,c,d}	38.83 (13.00) ^{a,c,d}	42.07 (17.28) ^{b,c,d}	60.73 (11.90) ^{c,d}	72.22 (9.68) ^d	151.29	<.001	.67

Notes. BAI = Beck Anxiety Inventory; CDS = Cambridge Depersonalization Scale; DES = Dissociative Experiences Scale; CDS-AB = CDS anomalous body experience; CDS-EN = CDS emotional numbing; CDS-ASR = CDS anomalous subjective recall; CDS-AfS = CDS alienation from surroundings; DES-DPDR = DES depersonalization-derealization; DES-AM = DES amnesia; DES-AI = DES absorption and imaginative involvement; CDS-S = CDS

state. Superscripted letters indicate significant differences ($p < .05$) between classes marked with paired letters according to Tukey's HSD test.

differences in depersonalization-derealization symptoms with the High severity class exhibiting the highest anomalous bodily experience, emotional numbing and anomalous subjective recall subscale scores, and the High depersonalization class characterized by elevated alienation from surroundings scores. Further, the High depersonalization class exhibited significantly higher scores on all CDS subscales as well as the state CDS than the High dissociation class, indicating more severe broad depersonalization symptoms.

3.3.3 DES

There were also significant main effects of Class on all DES subscales. All classes significantly differed on the DPDR subscale with large effects ($ps < .001$, g range: 1.47-5.42) except the High dissociation and High depersonalization classes ($p = .55$, $g = 0.31$). All classes significantly differed on the AM subscale with moderate to large effects ($ps < .001$, g range: 0.70 – 2.46) except the High dissociation and High severity classes ($p = .81$, $g = 0.30$). All classes significantly differed on the AI subscale with large effects ($ps < .001$, g range: 0.88 – 4.32). Overall, these results suggest that the classes were markedly different from each other with the High severity class exhibiting the highest levels of dissociation across subscales, and the High dissociation class characterized by elevated amnesia and absorption and imaginative involvement subscale scores. This is particularly interesting in relation to the High depersonalization class, which did not significantly differ in depersonalization from the High dissociation class even though the latter displayed more severe dissociative amnesia and absorption scores. This suggests that the High dissociation class experiences a higher severity of broad compartmentalization symptoms, as compared to the High depersonalization class.

3.4 Differences across symptoms, precipitating factors and comorbid diagnoses

3.4.1 Symptoms

The classes were compared on six non-dissociative symptoms (**Table 4**). There was a main effect of Class on panic attacks with the High dissociation class reporting significantly more attacks than the High depersonalization ($p < .001$, $\phi = .36$), Low Severity ($p = .003$, $\phi = .29$) and Moderate severity ($p = .006$, $\phi = .26$) classes. There were no other significant class differences (all $ps > .14$). There was a main effect of Class on hallucinations, with both the High severity class and the High depersonalization class reporting significantly more hallucinations than the Low severity class ($p < .001$, $\phi = .34$; $p = .020$, $\phi = .21$, respectively). No other significant class differences were observed (all $ps > .24$). There was a main effect of Class on OCD compulsive behaviour, with the High severity class reporting significantly more OCD compulsive behaviour than the High dissociation ($p = .006$, $\phi = .38$), Low Severity ($p = .015$, $\phi = .25$), and Moderate severity classes ($p = .027$, $\phi = .22$). There were no other significant Class differences (all $ps > .20$). There were no significant effects for the other symptoms, with corresponding low effect sizes. These results are broadly consistent with the most severe class (High severity) being characterized by a propensity for other psychiatric symptoms including hallucinations and compulsive behaviour but with panic attacks being the most prevalent for those in the High dissociation class.

Table 4.
Non-dissociative symptoms, precipitating factors and comorbidities as a function of latent class

Symptoms	Low Severity	Moderate Severity	High Dissociation	High Depersonalization	High Severity	N	χ^2	P	Φ
	% (n) [n]	% (n) [n]	% (n) [n]	% (n) [n]	% (n) [n]				
Panic attacks	65% (46) ^c [71]	68% (54) ^b [79]	93% (28) ^{a,b,c} [30]	59% (32) ^{a,d} [54]	80% (20) ^d [25]	180	2.80	.012*	.22
OCD persistent thoughts	65% (45) [69]	72% (58) [81]	83% (24) [29]	68% (36) [53]	85% (23) [27]	186	.98	.20	.15
Hallucinations	9% (6) ^{a,b} [67]	19% (15) [79]	23% (7) [30]	25% (13) ^b [30]	37% (10) ^a [27]	51	10.98	.027*	.21
Fainting attacks	19% (13) [68]	19% (15) [78]	27% (8) [30]	15% (8) [53]	33% (9) [27]	53	4.50	.34	.13
OCD compulsive behaviour	24% (16) ^b [67]	27% (21) ^c [79]	15% (4) ^a [27]	35% (17) [49]	50% (13) ^{a,b,c} [26]	71	10.12	.039*	.20
Recurrent headaches	24% (15) [62]	35% (27) [77]	44% (12) [27]	44% (23) [52]	39% (9) [23]	86	6.26	.18	.16
Precipitating factors									
Substance-related factors	14% (7) ^{a,b} [50]	40% (27) ^a [68]	31% (5) [16]	33% (12) ^b [36]	18% (3) [17]	54	0.71	.030*	.24
Psychological factors	43% (20) [46]	39% (25) [64]	25% (4) [16]	51% (18) [35]	47% (8) [17]	75	3.62	.46	.14
Situational factors	20% (10) [49]	18% (12) [67]	13% (2) [16]	31% (11) [35]	24% (4) [17]	39	3.43	.49	.14
Traumatic factors	16% (8) [50]	17% (11) [66]	19% (3) [16]	26% (9) [35]	24% (4) [17]	35	1.78	.78	.10
Social factors	14% (7) ^a [49]	14% (9) ^{b,c} [66]	19% (3) [16]	40% (14) ^{a,b} [35]	35% (6) ^c [17]	39	13.10	.011*	.27
Physical factors	20% (10) [49]	15% (10) [66]	19% (3) [16]	12% (4) [34]	6% (1) [17]	28	2.61	.62	.12
Current comorbidities									
Major depression	31% (19) [61]	43% (33) [77]	39% (9) [23]	33% (16) [48]	44% (12) [27]	89	2.92	.57	.11
Panic disorder	1% (3) [60]	12% (8) [69]	18% (4) [22]	11% (5) [46]	19% (5) [26]	25	5.10	.28	.15
Anxiety	37% (22) [60]	44% (31) [70]	43% (9) [21]	28% (13) [47]	35% (9) [26]	84	3.68	.45	.13
OCD	1% (3) [60]	10% (7) [71]	14% (3) [22]	10% (5) [48]	10% (2) [27]	20	2.05	.73	.10
Agoraphobia	3% (2) [60]	1% (1) [69]	5% (1) [22]	0% (0) [45]	12% (3) [26]	7	8.25	.08	.19
Schizophrenia	5% (3) [61]	1% (1) ^a [69]	0% (0) [22]	4% (2) [45]	15% (4) ^a [26]	10	9.76	.045*	.21
Drug abuse	0% (0) [60]	1% (1) [69]	0% (0) [22]	0% (0) [45]	0% (0) [26]	1	2.23	.69	.10
Alcohol abuse	0% (0) [60]	1% (1) [69]	0% (0) [22]	2% (1) [45]	0% (0) [26]	2	2.09	.72	.10
Bipolar disorder	2% (1) [60]	1% (1) ^a [69]	0% (2) [22]	11% (5) ^a [46]	0% (0) [26]	9	10.15	.038*	.21

Notes. Superscripted letters indicate significant differences between classes marked with paired letters. * $p < .05$

3.4.2 Precipitating Factors

The classes were next compared on six variables corresponding to patients' subjective reports of the factors that precipitated their symptoms (Table 4). There was a main effect of

Class on substance-related factors with significantly more patients in both the Moderate severity

and the High depersonalization classes attributing their DDD symptoms to substance-related factors than those in the Low severity class ($p = .002$, $\phi = .28$; $p = .033$, $\phi = .23$, respectively). There were no other significant class differences (all $ps > .11$). There was a main effect of Class on social factors with significantly more patients in the High depersonalization class attributing their symptoms to social factors than those in the Low severity ($p = .007$, $\phi = .29$) and Moderate severity ($p = .003$, $\phi = .30$) classes. There were also significantly more patients in the High severity class attributing their symptoms to social factors than those in the Moderate severity class ($p = .039$, $\phi = .23$). There were no other significant class differences (all $ps > .14$). There were no significant Class effects for the other factors, with corresponding low effect sizes. Overall, patients in the Moderate severity class were more likely to attribute their symptoms to substance-related factors whereas those in the High depersonalization class were more likely to attribute symptoms to social factors.

3.4.3 Comorbidities

Our final set of analyses examined whether the classes differed on nine current comorbid diagnoses (**Table 4**). There was a main effect of Class on comorbid schizophrenia with the High severity class exhibiting significantly more comorbid diagnoses than the Moderate severity class ($p = .019$, $\phi = .28$). There were no other significant class differences (all $ps > .11$). There was also a main effect of Class on comorbid bipolar disorder with the High depersonalization class exhibiting significantly more comorbid diagnoses than the Moderate severity class ($p = .037$, $\phi = .21$). There were no other significant class differences (all $ps > .14$). No other significant Class effects were observed for the other current comorbid diagnoses, with corresponding low effect sizes. Overall, the High severity class was the most likely to have a current comorbid diagnosis

of schizophrenia whereas the High depersonalization class was the most likely to have a current comorbid diagnosis of bipolar disorder.

4. Discussion

This study used latent profile analysis (LPA) to assess the extent to which symptom heterogeneity in DDD can be understood to reflect the presence of discrete latent classes. The analyses yielded evidence for five distinct classes of DDD patients with three comprising subtypes based on severity (Low severity, Moderate severity, High severity), and two subtypes differing primarily on detachment and compartmentalization dissociative symptomatology (High depersonalization, High dissociation) (Brown, 2006; Holmes et al., 2005). Further analyses suggest that these classes display broader differences in non-dissociative symptoms. The results suggest that symptom heterogeneity in DDD is potentially attributable to discrete symptom subgroups with implications for the aetiology, mechanisms, and treatment of this condition.

Aside from different severity classes, the most notable distinction between classes were the divergent patterns of detachment and compartmentalization symptoms in the High dissociation and High depersonalization subtypes. The High depersonalization class exhibited uniformly higher scores on all CDS subscales (Sierra & Berrios, 2000) and the state CDS (Baker, Hunter, Lawrence, & David, 2007) relative to the High dissociation class, as well as the most severe scores on the alienation from surroundings CDS subscale (Sierra et al., 2005; Baker et al., 2007). The symptoms that were elevated in the High depersonalization class sit at the core of a DDD diagnosis where a feeling of detachment from one's mental states, body, or self and a detachment and sense of unreality from one's surroundings are characteristic symptoms of this condition (Hunter, Salkovskis & David, 2014).

In contrast, the High dissociation class exhibited more severe amnesia symptoms as well as absorption and imaginative involvement experiences than the High depersonalization class. This suggests that the former class is perhaps better distinguished by the reporting of compartmentalization symptoms (Holmes et al., 2005; Brown, 2006). Compartmentalization symptoms involve a subjective inability to exercise deliberate control over particular processes or actions and may materialize as amnesia, behavioural or emotional dysregulations, fugue and functional neurological symptoms (Spitzer, Barnow, Freyberger, & Grabe, 2006). Although commonly reported in other DSM-5 dissociative disorders, such as *dissociative amnesia* and *dissociative identity disorder* (Spiegel et al., 2013), they are not a core feature of DDD (American Psychiatric Association, 2013; Hunter et al., 2003). The only dissociative measure in which the High dissociation and High depersonalization classes did not significantly differ was the DES depersonalization-derealization subscale. Insofar as this subscale typically correlates strongly with the CDS (Sierra & Berrios, 2000), these results potentially reflect a context effect wherein depersonalization symptoms were rated in the context of other dissociative symptoms, thereby elevating this subscale score in the High dissociation class (Council, 1993).

Class differences become more pronounced when examining particular subscales of the CDS and DES. For example, the DES absorption and imaginative involvement subscale provided the clearest separation of the five classes and class severity. Dissociative absorption reflects the degree to which an individual can be immersed in or absorbed by an external stimulus or their own internal imagination (Carlson & Putnam, 1993; Soffer-Dudek, 2015; Soffer-Dudek, 2018; Schimmenti & Sar, 2019). A vivid imagination and inclination to become completely absorbed by a stimulus whilst ignoring the rest of one's environment can, in extreme contexts, lead to impaired reality monitoring (Soffer-Dudek, 2015). Elevated dissociative absorption potentially

contributes to, or covaries with, broader symptom severity including feelings of automaticity and a loss of the sense of self or agency (Bregman-Hai, Kessler, & Soffer-Dudek, 2020) and the other non-dissociative symptoms and psychiatric comorbidities observed in the most severe DDD classes.

A notable finding was that anxiety was not a strong indicator of class differences within this sample. All five classes were relatively comparable in anxiety scores with the exception of the High severity class, which exhibited the most severe scores. These results are potentially at odds with research on the association between depersonalization-derealization and anxiety symptoms in DDD (Sierra et al., 2012). The apparent inconsistencies indicate that the relationship between depersonalization and anxiety is complex. Further research into this question will require a wider range of anxiety measures that better explore both different forms of anxiety including PTSD (Lanius et al., 2012), panic disorder (Segui, Ma'rquez, Garcia, Canet, Salvador-Carulla, & Ortiz, 2000) and OCD (Soffer-Dudek, 2018) and their specific symptoms. With the dissociative subtype of PTSD being primarily defined by the presence of depersonalization-derealization symptoms (Choi et al., 2017), further research would benefit from measuring PTSD symptoms including flashbacks and hypervigilance (PCL-5; Blevins, Weathers, Davis, Witte, & Domino, 2015), within DDD.

Class differences extended to multiple non-dissociative psychiatric symptoms. As expected, the most severe class (High severity) was characterized by a greater propensity for other psychiatric symptoms including OCD compulsive behaviour. Obsessive checking or monitoring of symptoms, which can precipitate compulsive behaviours, is frequent in DDD (Simeon & Hollander, 1993; Baker et al., 2003) and may reflect an attempt to cope with depersonalization-derealization symptoms. Beyond this, it has been suggested that absorption, as

more strongly reported by the High severity class, could be a risk factor for developing obsessive-compulsive behaviour or symptoms (Soffer-Dudek, 2018). Hallucinations were most common in the High severity and High depersonalization classes. This aligns with research demonstrating that depersonalization, anxiety and absorption are reliable predictors of hallucination-proneness (Perona-Garcelan et al., 2012; Baker et al., 2003; Sierra et al., 2012) and independent work documenting robust associations between dissociative symptoms and hallucinations (Pilton, Varese, Berry, & Bucci, 2015). Finally, panic attacks were most commonly reported in the High dissociation class. This corroborates previous research documenting associations between panic attacks and dissociative symptoms (Segui et al., 2000; Baker et al., 2003; Hunter et al., 2003; Sierra et al., 2012) and a high prevalence of symptoms of depersonalization and the disorder itself in patients diagnosed with panic disorder (Mendoza et al., 2011).

Another route for interpreting these different subtypes is the experience of comorbid psychiatric disorders. The High severity class exhibited an increased rate of comorbid schizophrenia, which aligns with their increased reporting of hallucinations (Perona-Garcelan et al., 2012; Varese, Barkus, & Bentall, 2012; Longden et al., 2020) and with the high frequency of dissociative symptoms in schizophrenia (O'Driscoll, Laing, & Mason, 2014). There is also a documented relationship between dissociation and a history of trauma in schizophrenia spectrum disorders (Renard et al., 2017) wherein patients with PTSD and schizophrenia with a history of trauma exhibited significantly higher dissociative symptoms as compared to schizophrenic patients with no trauma history (Wearne et al., 2020). The High depersonalization class was characterized by a higher rate of comorbid bipolar disorder. This is in line with research indicating a high prevalence of comorbid depression in DDD patients (Baker et al., 2003; Michal

et al., 2016), the presence of lifetime dissociative symptoms in individuals with bipolar disorder (Mula et al., 2009) and an association between the severity of dissociation and self-reported trauma history in both patients with bipolar disorder (Tuineag et al., 2020) and borderline personality disorder (Sar, Alioglu & Akyuz, 2017).

Beyond symptoms and comorbidities, a further interpretation of these latent classes is that the differential expression of DDD arises from different antecedent factors. Analyses of patient's subjective reports of factors that precipitated their DDD symptoms revealed that patients in the Moderate severity class mostly attributed their symptoms to substance-related factors whereas those in the High depersonalization and High severity classes tended more to attribute their symptoms to social factors. Previous research suggests that DDD can be triggered by a range of factors including, but not limited to, a traumatic event, severe stress, panic, and consumption of drugs including marijuana or hallucinogens (Hunter, Charlton & David, 2017). However, self-reported precipitating factors were not particularly robust discriminators among the five classes. Although these subjective appraisals should be interpreted with caution, they can lend insights into patients' *perceptions* of their symptoms, which may play an important role in their management and experience of the disorder (Petrie & Weinman, 2012) and could be an important target for treatment.

Despite the advances afforded by the present analyses, they need to be considered in the context of multiple limitations. Although we included three measures with eight sub-factors of dissociation and depersonalization, only one indicator of anxiety was included in the analysis, which plausibly reduced the influence of anxiety symptoms in the demarcation of DDD classes. Future research will need to achieve greater balance in the relative assessment of anxiety and other symptoms in order to more robustly assess the possibility of a subtype of DDD

characterized by high anxiety and low depersonalization-derealization (Sierra et al., 2012). A further limitation is missing data. Any variables with missing data for more than half of the patients were automatically excluded from our analyses. Therefore, some important discriminating variables including other non-dissociative symptoms and comorbidities may have been excluded. A further limitation of the study is that we did not formally assess the presence of other dissociative disorders, such as dissociative amnesia. The symptomatology of certain DDD classes (e.g., High dissociation and High severity) may have high overlap with other dissociative disorders, and dissociative disorder comorbidities should be considered in further research on symptom heterogeneity in DDD. Lastly, all measures included in this analysis were self-report including previous diagnoses which were not verified. Future attempts to segregate these different subtypes will benefit from the use of neurophysiological measures as well as cognitive-perceptual measures such as interoceptive awareness or accuracy (Schandry, 1981) and time perception (Wearden, 1991).

The identification of these discrete subtypes of DDD characterized by dissimilar profiles of dissociative symptomatology may have implications for treatment. The relatively high levels of psychiatric symptoms and co-morbidity in the sample indicate the need for careful and thorough clinical assessments leading to individualized treatment formulations. These formulations should incorporate the role that specific psychiatric symptoms and co-morbidities might play in the onset and maintenance of the DDD, requiring an integrated approach to treatment (Hunter, 2013). The High severity class, encompassing approximately 10% of DDD patients, would require a more multidisciplinary plan with experienced practitioners that covers a broader and more severe symptom profile than those in the Low severity class. The High depersonalization and High dissociation classes may respond differently to the same treatment

and therefore are likely to require more specific and tailored forms of treatment. Individuals in the High dissociation class may find more benefit from CBT or psychotherapy targeting symptoms of amnesia and absorption and attachment, while those in the High depersonalization class may benefit from specific CBT treatments (e.g. Hunter et al., 2005) focused on alleviating feelings of disembodiment and detachment, plus techniques such as grounding exercises and mindfulness (Nestler et al., 2015).

5. Conclusions

This analysis identified three DDD subtypes reflecting differential general severity levels, as would be expected and as previously observed in symptom fractionation analyses of other psychiatric conditions (Lanius et al., 2012; Au, Martinez de Andino, Mekawi, Silverstein, & Lamis, 2020). Beyond this, we identified a split between dissociative symptoms (amnesia, absorption) and broader depersonalization symptoms in DDD that aligns with the two qualitatively different categories of dissociative symptoms: *compartmentalization* and *detachment* (Brown, 2006). Within the DDD diagnosis, there emerges a subgroup that selectively experiences heightened detachment symptoms, central to DDD, and another subgroup that experiences increased compartmentalization symptoms often seen in other dissociative disorders (Spitzer et al., 2006). Although these analyses suggest that symptom heterogeneity in DDD is partially explained by latent classes, further research is needed to better examine measures of anxiety within this population and assess the replicability of these symptom subtypes.

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