

# Association Between Autism Spectrum Disorder and Eating Disorders without Self-Induced Vomiting: An Empirical Study

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## Research article

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# Abstract

**PURPOSE:** Previous studies have shown links between autism spectrum disorder and anorexia nervosa restricting type. However, few have examined the association between autism spectrum disorder and other eating disorder subtypes, such as bulimia nervosa, anorexia nervosa binge-purging type and binge eating disorder. In this study, we aimed to assess the presence of autism spectrum disorder tendencies in each eating disorder and to explore whether an association exists between traits of autism spectrum disorder and eating disorders with or without self-induced vomiting.

**METHODS:** We retrospectively sampled outpatients who attended Chiba University Hospital between 2012 and 2016 (43 females aged 15–45 years). All were assessed using the Eating Disorder Examination Questionnaire and Autism Spectrum Quotient to quantify the severity of the eating disorder and to identify whether autism spectrum disorder traits were present. Additionally, the subtype at onset, the change in subtype from onset to presentation and the difference based on the presence or absence of self-induced vomiting were investigated.

**RESULTS:** We found that the Autism Spectrum Quotient tended to be higher in the group without, than in the group with, self-induced vomiting. Patients with binge eating disorder had the highest Autism Spectrum Quotient at presentation, and most of them had transitioned from prior anorexia nervosa restricting type.

**CONCLUSION:** Of note, although their subtype had changed over time, the trait of not vomiting had remained consistent. There was a difference in the Autism Spectrum Quotient score by the presence or absence of self-induced vomiting.

**Level of Evidence: LEVEL IV** (Evidence obtained from multiple time series without the intervention).

## Plain English Summary

It is known that 18%–23% of patients with anorexia nervosa have comorbid autism spectrum disorder. However, no study has examined the association with autism spectrum disorder by subtypes of anorexia nervosa (restricting type and binge with self-induced vomiting type). In addition, no studies have examined the association of autism spectrum disorder with other subtypes of eating disorders.

As a result of examining the autism spectrum disorder tendency for each eating disorders subtype, it was found that the type of eating disorders that did not self-induced vomiting had a higher autism spectrum disorder tendency than with self-induced vomiting.

Overall, 80% of people diagnosed with binge eating disorder had been diagnosed with restricting type of anorexia nervosa at the time of onset. For some restricting type of anorexia nervosa patients, fear or aversion to vomiting can be stronger than the desire not to gain weight, it may be the influence of the autism spectrum disorder tendency.

# 1. Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), eating disorders (EDs) can be grouped into anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED)[1, 2]. AN can then be further divided into a restricting (AN-R) type and a binge eating with self-induced vomiting (AN-BP) type. Patients frequently transition from one ED type to another, typically from the AN-R type to the AN-BP type [3], likely because strict dietary restrictions cannot be maintained for a long time. It is, however, less common for a person experiencing AN-BP to stop the self-induced vomiting [3]. All subtypes share certain features, such as distorted body image, excessive dieting (leading to severe weight loss) and a pathological fear of becoming fat [4].

It is interesting that many of the common features of EDs are similar to the cognitive rigidity in the presence of changing environmental demands that is often seen in autism spectrum disorder (ASD) [5]. This may indicate a pathological link between the two disorders, with some studies indicating that 18–23% of patients with AN have comorbid ASD [6, 7]. Given that the prevalence of ASD is 1% of the general population, the numbers with a comorbid ED must be quite high [6]. Other research has shown that scores on the Eating Disorder Examination Questionnaire (EDE-Q) were significantly and positively correlated with those on the Autism Spectrum Quotient (AQ), 10-item version, but not with the body mass index (BMI) [8]. This correlation has also been observed in studies of adults and adolescents with AN [9, 10].

Studies have shown that prognosis may be worse when EDs and ASD are comorbid [6, 5, 11]. For example, one study reported that treatment outcomes were significantly worse if ASD coexisted with AN [9]. The treatment of EDs needs to be customised to account for the symptoms of ASD in these settings. However, although studies have considered the association between AN and ASD [8], relatively few have considered the association between ASD and other ED subtypes. Given that many people transition between these subtypes, it is logical that research should be expanded. It has also been our clinical observation that patients presenting without self-induced vomiting are more resistant to treatment [12, 13].

In this study, we planned to examine the clinical association between ED and ASD. We hypothesised that the absence of self-induced vomiting may be associated with the presence of ASD, but to date, no studies have examined the relationship between EDs and ASD regarding the presence or absence of self-induced vomiting. We believe that clarifying this relationship is essential to determining the appropriate treatment and support in ED subtypes with and without self-induced vomiting. Thus, we aimed to investigate the presence of ASD symptoms by ED subtype and to explore whether there was a difference by the presence or absence of self-induced vomiting.

## 2. Materials And Methods

### 2.1 Sample and procedure

We retrospectively sampled outpatients who attended Chiba University Hospital between 2012 and 2016. Patients were included if they had AN, BN or BED, but were excluded if they had an atypical ED. However, a patient with atypical ED who did not fully meet the criteria for AN, BN, and BED and one chewing was included in this study. Among those included, we then divided them into groups with self-induced vomiting (BN) and without self-induce vomiting (AN-R and BED) at the time of assessment. Subjects were diagnosed by a psychiatrist with experience in EDs, using the DSM-IV revised criteria [14] and the DSM-5[2]. Self-report questionnaires were completed by subjects at the beginning of the study. The Institutional Ethics Committee of Chiba University Graduate School of Medicine approved the study (no. 3431), and all subjects provided written informed consent.

## **2.2 Measures**

Relevant demographic data were collected, including age, duration of illness and BMI. ED severity was assessed using the global EDE-Q score [15], whereas autistic traits were assessed using the AQ [16].

### **2.2.1. Eating Disorder Examination Questionnaire**

The EDE-Q is a standardised and well-validated 36-item self-report questionnaire that measures the severity of ED symptoms and behaviours in the 28 days leading up to the survey [15]. In the questionnaire, patients are asked to rate how often they have engaged in specific ED behaviours or held ED concerns during the previous 28 days. The questionnaire generates scores for four subscales —“dietary restraint,” “weight concern,” “shape concern” and “eating concern”—together with a global score that reflects overall illness severity. The maximum global score is 6, with higher scores indicating greater severity. The optimal cutoff score is 2.5 for discriminating between those with the disorder and healthy controls[17].

### **2.2.2. The Autism Spectrum Quotient**

The 50-item AQ was developed to provide a brief self-report measure of autistic traits in adults, but was not designed to be used as a diagnostic tool despite its widespread use. The AQ consists of five domains associated with ASDs: social skills, attention switching, attention to detail, communication and imagination. Each question allows the subject to indicate “definitely agree,” “slightly agree,” “slightly disagree,” or “definitely disagree.” Approximately half the questions are worded to elicit an “agree” response and half to elicit a “disagree” response in neurotypical individuals. The cutoff score for ASD is 33 [16, 18].

## **2.3. Statistical analysis**

All data were reported as means and standard deviations or numbers (number of people) and percentages as appropriate. Demographic data were analysed by Kruskal–Wallis analysis and multiple comparisons were performed by the steel-dwass method. In addition, AQ scores with and without self-induced vomiting and EDEQ scores were compared using the Mann–Whitney test. Finally, the ratio of the

subtypes and the number of patients who exceeded the cutoff value of the AQ score was determined, and the difference in the ratio of the number of patients was examined by Fisher's exact test. We also calculated the effect size using Cramer's V. A Cramer's V > 0.10 was used as the criterion for a small effect, a value > 0.30 as a medium effect, and > 0.50 as a large effect ([http://jspt.japanpt.or.jp/ebpt\\_glossary/effect-size.html](http://jspt.japanpt.or.jp/ebpt_glossary/effect-size.html)). The Statistics were performed using the STAT statistical package and js-STARversion 9.7.8j.

## 3. Results

### 3.1 Demographic analysis and clinical characteristics

In total, 43 female outpatients aged 12–41 years (mean  $26.4 \pm 7.8$  years) were enrolled with illness durations of 0.5–20 years (mean  $6.4 \pm 5.8$ ). All diagnoses were first made at the time of assessment for this study. The sample comprised the following diagnoses: 23 with BN (53.5%), 8 with AN-BP (18.6%), 6 with AN-R (14.0%), 5 with BED (11.6%) and 1 with an atypical ED (2.3%). The patient with an atypical ED was excluded from the analyses. Among the remaining patients, only 11 did not self-induce vomiting (i.e., had AN-R and BED) at the time of the hospital admission. The clinical and demographic characteristics are summarised in Table 1.

As shown, the groups were not significantly different in terms of their age and illness duration. However, the AN group had a significantly lower BMI (AN-R:  $15.6 \pm 1.5$ , AN-BP:  $17.0 \pm 0.7$ ) compared with the other groups (BN:  $20.4 \pm 2.4$ , BED:  $24.3 \pm 7.0$ ) ( $H = 26.3, p < 0.01$ ). There were also statistically significant differences between the purging and non-purging groups in the EDE-Q global scores for clinical severity. Two bulimic purging subtypes (BN and AN-BP) scored higher than non-purging subtypes ( $U = 67.5, p < 0.01, r = 0.46$ ).

Finally, Table 1 also shows that the average of AQ total score was highest for patients with BED ( $32.4 \pm 6.2$ ), followed by those with AN-R ( $26.0 \pm 7.5$ ), AN-BP ( $25.3 \pm 4.8$ ) and BN ( $22.1 \pm 6.4$ ). The difference between BN and BED was significant for the attention to detail score (BN:  $3.2 \pm 2.0$ , BED:  $7.6 \pm 2.5$ ) ( $H = 9.4, p < 0.05$ ).

Table 1  
Clinical profiles of the 42 subjects

	<b>BN</b>	<b>AN-BP</b>	<b>AN-R</b>	<b>BED</b>	<b>Kruskal– Wallis analyses</b>	
	n = 23	n = 8	n = 6	n = 5	H	Multiple Comparisons by Steel-Dwass
	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)		
Illness Duration	6.4 (5.8)	10.0 (6.7)	1.9 (1.7)	4.6 (3.7)	8.2*	AN-BP > AN-R
BMI	20.4 (2.4)	17.0 (0.7)	15.6 (1.5)	24.3 (7.0)	26.3**	BN > AN-BP, BN > AN-R, AN-BP < BED, AN-R < BED
age	27.0 (7.0)	28.1 (7.0)	18.6 (4.8)	28.7 (11.2)	8.3*	N.S
<b>EDE-Q</b>						
Diagnosis	74.5 (40.8)	78.8 (39.4)	15.2 (11.5)	62.2 (45.8)	12.8**	BN > AN-R, AN-BP > AN-R
Restricting	3.4 (1.7)	5.2 (1.0)	2.4 (1.5)	4.0 (1.6)	10.7*	AN-BP > AN-R
Eating	3.4 (1.5)	4.9 (0.6)	2.0 (1.4)	3.8 (1.9)	10.9*	AN-BP > AN-R
Weight	4.4 (1.4)	5.4 (0.6)	2.6 (1.9)	5.2 (0.5)	10.2*	AN-BP > AN-R
Shape	4.6 (1.4)	5.1 (0.7)	2.8 (1.8)	5.3 (0.5)	6.6	N.S
Global Score	3.9 (1.3)	5.0 (0.5)	2.4 (1.6)	4.5 (0.9)	10.5*	AN-BP > AN-R
<b>AQ</b>						
Total score	22.1 (6.4)	25.3 (4.8)	26.0 (7.5)	32.4 (6.2)	7.6	N.S
Social skills	4.7 (2.5)	5.1 (2.6)	5.7 (3.6)	8.0 (1.0)	7.8*	N.S
Attention Switching	5.7 (1.9)	7.1 (1.6)	6.2 (1.8)	6.4 (1.5)	2.9	N.S
Attention details	3.5 (2.0)	5.3 (3.3)	4.0 (1.7)	7.6 (2.5)	9.4*	BN < BED

	BN	AN-BP	AN-R	BED	Kruskal– Wallis analyses	
Communication Skills	3.8 (2.3)	4.4 (1.1)	6.0 (2.1)	6.2 (1.3)	8.7*	N.S
Imagination	4.4 (2.0)	3.4 (1.8)	4.2 (1.5)	4.2 (2.2)	2.2	N.S
BN:Bulimia Nervosa; AN-BP:Anorexia Nervosa Binge Purging; AN-R:Anorexia Nervosa Restricting; BED:Binge Eating Disorder;  BMI:Body Mass Index; EDE-Q:Eating Disorder Examination Questionnaire; AQ:Autism Quotient.  **p < 0.01 *p < 0.05						

## 3.2. AQ score and the presence of self-induced vomiting

As observed, 31 patients self-induced vomiting and 11 did not self-induce vomiting. However, although there was a significant difference in illness duration between them, there were no significant differences in age or BMI. Also, there were no significant differences in the EDE-Q, except for the “diagnosis” category, which is expected to be affected by the frequency of self-induced vomiting. The AQ total scores of those who did not self-induce vomiting were significantly higher than for those who self-induced vomiting (Table 2). In particular, the scores for social and communication skills—which are subscales of the AQ—were significantly higher in the group that did not self-induce vomiting.

Table 2  
Comparison of AQ scores by the presence or absence of self-induced vomiting (n = 42)

	<b>AN-R,BED vomitting(+)</b>	<b>BN,AN-BP vimitting(-)</b>	<b>Mann-Whitney</b>		
	n = 31	n = 11			
	Mean (sd)	Mean (sd)	<i>U</i>		<i>r</i>
Duration	7.3 (6.2)	3.1 (3.0)	100.5	*	0.31
BMI	19.5 (2.6)	19.6 (6.5)	132.5		
age	27.3 (6.9)	23.2 (9.5)	111.0		
<b>EDE-Q</b>					
Diagnosis	75.6 (39.8)	36.5 (38.8)	67.5	**	0.46
Restricting	3.9 (1.7)	3.1 (1.7)	116.0		
Eating	3.8 (1.5)	2.8 (1.8)	112.0		
Weight	4.6 (1.3)	3.7 (1.9)	123.5		
Shape	4.7 (1.3)	3.9 (1.8)	140.0		
Global Score	4.2 (1.2)	3.4 (1.7)	120.0		
<b>AQ</b>					
Total score	22.9 (6.1)	28.9 (7.4)	102.5		
Social skills	4.8 (2.5)	6.7 (2.9)	89.5	*	0.36
Attention Switching	6.0 (2.0)	6.3 (1.6)	153.0		
Attention details	3.9 (2.5)	5.6 (2.7)	103.0		
Communication Skills	4.0 (2.1)	6.1 (1.7)	71.5	**	0.44
Imagination	4.2 (2.0)	4.2 (1.7)	166.0		
AN, anorexia nervosa (either -R for restricting or -BP for binge eating with self-induced vomiting); AQ, Autism Spectrum Quotient; BMI, body mass index; BN, bulimia nervosa; BED, binge eating disorder; EDE-Q, Eating Disorder Examination Questionnaire. **p < 0.01 *p < 0.05					

### 3.3. AQ score cutoff value by ED subtype

The ED subtype with most AQ scores  $\geq 33$  was BED (60%), also exceeding the expected value (Table 3). By contrast, few patients with BN had an AQ  $\geq 33$  (4.3%), and this amount was below the expected value. The deference between the BN and BED groups was significant ( $p = 0.02$ ).

Table 3  
Eating disorder diagnosis by AQ cutoff value (n = 42)

		BN	AN-BP	AN-R	BED	Fisher	Cramer's
AQ score		n (%)	n (%)	n (%)	n (%)	$\chi^2$	V
AQ $\geq$ 33	<i>Measured</i>	1 (4.3)	1 (12.5)	1 (16.7)	3 (60.0)	10.4*	0.50
	<i>Expected</i>	3.29	1.14	0.86	0.71		
AQ $\leq$ 32	<i>Measured</i>	22 (95.7)	7 (87.5)	6 (85.7)	5 (40.0)		
	<i>Expected</i>	19.71	6.86	5.14	4.29		

AN, anorexia nervosa (either -R for restricting or -BP for binge eating with self-induced vomiting); AQ, Autism Spectrum Quotient; BN, bulimia nervosa; BED, binge eating disorder. \* p < 0.05

### 3.4. Transition among the subtypes of ED

Fig. 1 shows the transition among subtypes. Of the 42 patients, most were diagnosed with AN-R at onset and the least were diagnosed with BN. Of the 20 patients with AN-R, at onset 10 transitioned to BN and 4 transitioned to BED, while the remaining 6 remained unchanged. By contrast only 1 patient initially had BED, but this increased to 5 patients at diagnosis (1 retained BED [20%] and 4 transitioned from AN-R [80%]). Thus, onset often started with AN-R, but most cases progressed to BN or BED over time.

Among the 6 patients with AQ scores  $\geq$  33, 3 with BED transitioned from AN-R and BED (2 AN-R, 1 BED), 1 with AN-R remained unchanged, 1 with AN-BP transitioned from BN and 1 with BN transitioned from AN-BP.

## 4. Discussion

To the best of our knowledge, this is the first study to compare the predisposition for ASD by ED subtype and the presence or absence of self-induced vomiting. Of the four ED subtypes, there was a greater tendency to have ASD among those with AN-R and BED, neither of which is associated with self-induced vomiting. Most patients were also diagnosed with AN-R at onset, and they tended to report efforts to lose weight or to reduce food consumption as the initial trigger for their disorder. However, the short illness duration in AN-R indicates that rigid food restrictions cannot continue for a long time, with most patients ultimately switching to other ED subtypes. Previous research has indicated that most patients switch to BN [3], because the patient's ability to control or restrict food lessens after the period of severe food restriction (i.e., as a normal physiological response to starvation). In turn, this leads to increased food consumption accompanied by self-induced vomiting in a belief that this will prevent weight gain while still being able to eat. The reasons why some patients maintain strict food restrictions and do not transition to other ED subtypes are less well understood. As shown in the current study, some patients with AN-R transition to BED. In these patients, the absence of self-induced vomiting means that they tend to be obese [19], and it is unclear why they do not vomit in the face of weight gain [20, 21].

The AQ scores of patients without self-induced vomiting were higher than those of patients with self-induced vomiting in this study. We propose that some characteristics of ASD predispose some patients to some of the observed changes in the absence of self-induced vomiting. It is possible that some patients do not transition from AN-R because they follow strict dietary rules, such as only eating certain items at all times, due to preservation of sameness. It may also be possible that some patients with BED do not vomit because another obsessive compulsion arising from ASD is stronger than the core psychopathology of the ED and the failure of severe restriction leads to acceptance of weight gain. This is seen clinically in our practice with comments such as “I am scared to vomit,” “My life is over when I am vomiting,” or “Looking at vomit disgusts me.” In such instances, the fear or aversion to vomiting might be stronger than the desire not to gain weight. Therefore, evaluating patients for the presence of self-induced vomiting when assessing them for EDs could help us to understand the association with ASD tendencies.

## 4.1. Strength and limitations

This study had some limitations. Of note, the sample size was small, there were differences in the number of participants in each subtype, and we only assessed the tendency for ASD using the AQ. There were no data for healthy subjects to compare patient data with standard values. Despite these limitations, there are several strengths. First, we are unaware of any retrospective observational study detailing a possible association between ASD tendency and vomiting in EDs (a problematic behaviour). Second, all data for this study were collected retrospectively from a clinical setting, which meant that we clarified not only the current diagnoses but also the change in diagnosis from the time of onset.

## 4.2. Conclusion

In conclusion, this study offers preliminary data that should prompt further research into the presence of ASD symptoms in each subtype of ED. This should explore whether there truly is a higher tendency for ASD to be associated with non-purging ED subtypes. However, the limitations of this study need to be addressed. This should involve excluding patients with extremely low body weights and including control subjects in a larger overall sample, while using a gold-standard method for ASD evaluation.

## Abbreviations

DSM-5: the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

EDs: eating disorders

AN: anorexia nervosa

BN: bulimia nervosa

BED: binge eating disorder

AN-R: restricting type of AN

AN-BP: binge eating with self-induced vomiting type

ASD: autism spectrum disorder

BMI: Body Mass Index

EDE-Q: Eating Disorder Examination Questionnaire

AQ: Autism Spectrum Quotient

## **Declarations**

## **Competing interests**

The authors do not have any competing interests to report.

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## **Contributors**

Author NN designed the study and collected data. Authors RS and MN provided summaries of previous research studies. Authors KI, KY and DM conducted the statistical analysis. ES and AN supervised the study. All authors contributed to, and have approved, the final manuscript.

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## **Compliance with ethical standards**

### **Conflict of interest**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

# Ethical approval

All procedures in the current study were in accordance with the ethical standards of the institutional research committee (Chiba University Graduate School of Medicine approved the study (no. 3431) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

# Informed consent

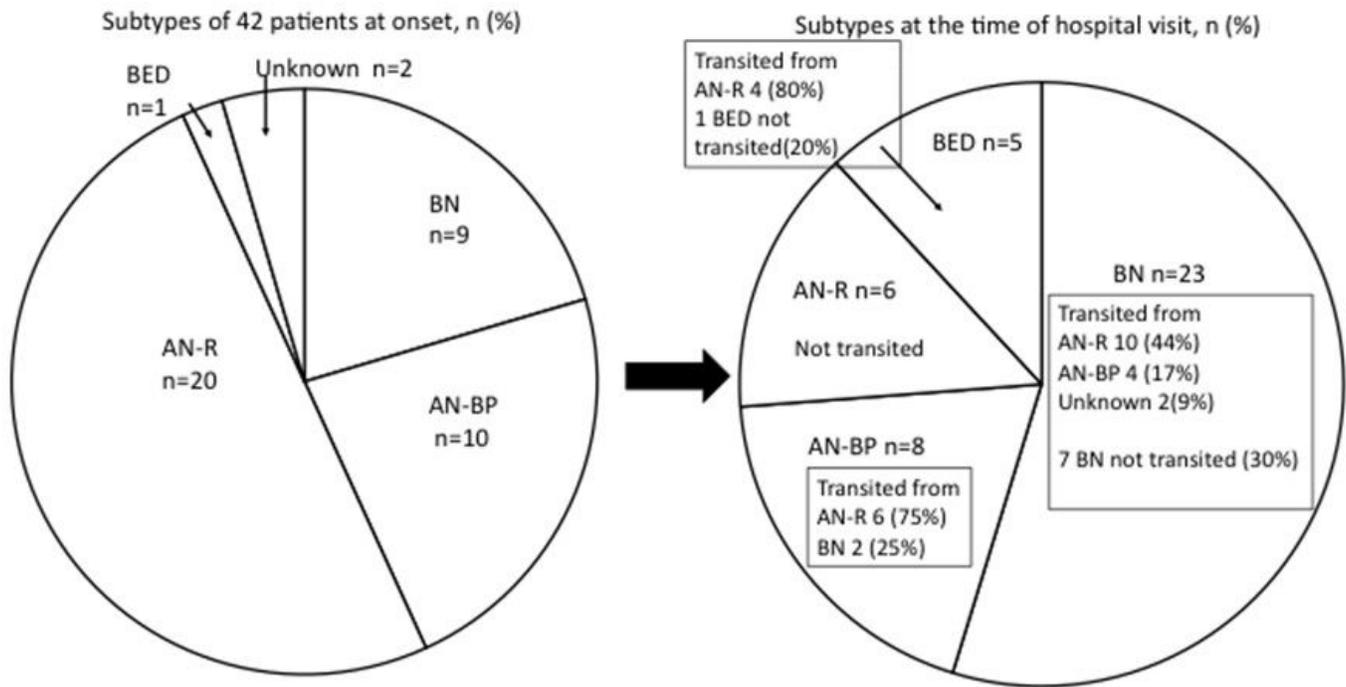
Informed consent was obtained from all individual participants included in the study. In case that the patient was a minor under the age of 18, an informed consent was obtained from their patient / caregiver. Also, the patients(adults) with 'autism spectrum disorder' were able to give informed consent on their own (because of the severity of the disease)

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## Figures



**Figure 1**

Change in ED subtype from onset to diagnosis

## Supplementary Files

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