

# Anxiety as a Link Between Stuttering and Irritable Bowel Syndrome

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
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## Abstract

**Objectives:** Although both stuttering, a complex speech disorder, and irritable bowel syndrome (IBS), a functional bowel disorder, are accompanied by high anxiety, the role of anxiety is not completely understood in either condition. Here, we explored the relationship between stuttering severity, IBS-like symptoms, and anxiety in adults who stutter (AWS) and compared AWS with IBS patients and healthy controls (HC).

**Methods:** We recruited 154 participants: 79 AWS (57M; age 16-40) completed the Rome IV IBS questionnaire, a questionnaire on IBS symptoms, State-Trait Anxiety Inventory (STAI-T), Visceral Anxiety Inventory (VSI) and Anxiety Sensitivity Index (ASI). Stuttering severity was also assessed. Thirty-nine IBS patients (11M; age 19-40) and 36 HC (10M, age 20-40) completed STAI, VSI and ASI.

**Results:** In AWS, correlations between IBS symptoms and STAI, VSI, and ASI were all significant and positive. Stuttering severity had no significant correlations. AWS with IBS-like symptoms had higher STAI, VSI and ASI scores than AWS without IBS-like symptoms. They also had higher STAI and VSI scores than HC.

**Conclusions:** AWS with IBS-like symptoms and IBS patients seem to have higher anxiety than HC and AWS without IBS-like symptoms. This could have implications for treatment in AWS with severe anxiety – other symptoms should be addressed to improve psychological functioning.

**Keywords:** Stuttering; irritable bowel syndrome; anxiety; visceral anxiety; anxiety sensitivity

## Introduction

Stuttering is a speech disorder characterized by involuntary disturbances in speech flow and timing [1,2]. The male to female ratio of stuttering is 4:1 in adulthood [3]. The causes of stuttering are not fully understood, but research points to a genetic basis, and possible deficits in neural processing [2,4]. Modern approaches to stuttering regard it as a complex disorder resulting from nonlinear

interactions of motor, linguistic and emotional factors [5]. Adults who stutter (AWS) typically report a wide range of difficulties, in addition to problems in communication skills, including low quality of life (QoL), disruptions in social and professional functioning, as well as negatively impacted emotions and cognitions [1,4,6].

AWS are prone to anxiety, with around 20% meeting the criteria

for social anxiety disorder. These individuals are more dissatisfied with their speech, more likely to avoid speaking and perceive the consequences of their stuttering more negatively compared to AWS without anxiety, regardless of similar stuttering severity [2]. Even in AWS without anxiety, speech fluency is typically more impaired when speaking to a group of people. However, research does not support a causal role for anxiety, but instead seems to indicate anxiety is a result of negative experiences with stuttering which lead to expecting future problems. In line with that, a reduction of stuttering symptoms leads to a reduction in anxiety but not vice versa [7]. Nevertheless, stuttering has a negative impact on QoL in AWS, which seems to be even more pronounced in AWS with high neuroticism [8]. It has previously been suggested that factors which affect QoL should be addressed in the treatment of AWS [5]. It follows that anxiety should be a target for treatment, even though it probably is not the cause, but rather a consequence of living with stuttering.

Irritable bowel syndrome (IBS) is a common functional gastrointestinal (GI) disorder. It results from complex interactions of different biological, psychological, and social factors [9,10]. IBS is characterized by abdominal pain and changes in stool frequency and consistency and is diagnosed based on patients' reports rather than medical tests [11]. IBS patients show high levels of neuroticism, anxiety, and depression. Neuroticism is considered a predisposing factor for the development of IBS and is generally seen as a key aspect of "illness prone personality" [12]. Research demonstrates the importance of anxiety for the development and perpetuation of IBS symptoms, but anxiety and depression can also be consequences of the chronic nature of IBS symptoms and impaired QoL [13].

Although IBS and stuttering are very different disorders, they are both characterized by anxiety. There is also a possibility that they share an underlying mechanism - immune dysfunction resulting from early adverse or stressful events. Altered immune functioning has been shown in IBS patients [14], while stuttering has been linked with atopic diseases which are characterized by a heightened inflammatory response of the immune system [15]. IBS patients report higher rates of early adverse events, such as trauma, abuse, and neglect [16,17]. Early adverse events are also risk factors for developing stuttering [3,15]. Such experiences can influence HPA axis functioning, and lead to an altered stress response, resulting in excessive exposure to cortisol and consequently alterations in neurogenesis and synaptogenesis [18], which could be relevant for the development of stuttering. Also, the HPA axis and the immune system are communication pathways between the microbiota and the brain, and their dysfunction can lead to bowel symptoms characteristic of IBS [14].

### Purpose of the study

The purpose of this study was to explore possible links between IBS symptoms and stuttering, particularly regarding aspects of anxiety. Our goal was to test if IBS-like symptoms were related to stuttering severity and anxiety in AWS, and to compare anxiety levels of AWS (with and without IBS-like symptoms) with those found in IBS patients and healthy controls (HC) of similar age.

## Methods

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committees of Clinical Hospital Centre Rijeka (February 6th, 2018.; Reg. No. 2170-29-02/15-18-2) and Clinical Hospital Sv. Duh Zagreb (January 25th, 2018.; Reg. No. 01-384).

### Participants

A total of 154 participants took part in the study. Seventy-nine AWS (57 men, 22 women; age  $M=25.12$ ;  $SD=5.44$ ; range 16-40) were recruited at the VaLMod rehabilitation centre where they were undergoing treatment for stuttering. Thirty-eight IBS patients (11 men, 28 women, age  $M=31.29$ ;  $SD=6.41$ ; range 19-40) were recruited at the Clinical Hospital Centre in Rijeka and Clinical Hospital "Sveti Duh" in Zagreb. The diagnosis was based on the Rome III criteria. Thirty-six HC (10 men, 26 women; age  $M=31.50$ ;  $SD=6.67$ ; range 20-40) were recruited at the University of Rijeka.

### Measures

AWS completed a demographic questionnaire (gender, age, marital, education, and employment status.), Rome IV IBS questionnaire, IBS symptoms questionnaire, State-Trait Anxiety Inventory (STAI-T), Visceral Anxiety Inventory (VSI) and Anxiety Sensitivity Index (ASI). IBS patients and HC completed a demographic questionnaire, STAI, VSI and ASI.

The severity of stuttering in AWS was assessed in a highly stressful situation on their first day at VaLMod. Each patient was tasked to narrate their biography for two minutes in front of a recording camera. The speech therapist simultaneously monitored spontaneous speech and recorded symptoms. Based on the total number of spoken and stuttered words, the average number of stuttered words was calculated, which, together with the estimated accompanying phenomena (tics, accompanying movements and other manifestations), was categorized as follows: 1 - very mild stuttering, 2 - mild stuttering, 3 - moderate stuttering, 4 - severe stuttering and 5 - very severe stuttering.

Trait anxiety was measured using the STAI, which measures dispositional tendencies towards anxiety. Normative data obtained for males aged 19-39 was 35.55 ( $SD=9.76$ ), and for females 36.15 ( $SD=9.53$ ). For patients with physical illnesses an average of 41.91 ( $SD=12.70$ ) was obtained [19].

Visceral anxiety was measured via the VSI, which measures different aspects of fear and anxiety that participants may experience in addition to their appraisals of GI sensations and discomfort [20].

Anxiety sensitivity was measured using the ASI which contains items referring to physical, social, and psychological worry [21].

The Rome IV IBS questionnaire was used to determine if participants fit the diagnostic criteria for IBS. Specifically, it was used to determine if they report having recurrent abdominal pain at least once a week, associated with two or more of the following: pain related to defecation, a change in stool frequency, and/or a change in stool consistency. Additionally, patients' symptom onset needs to be at least 6 months prior [22]. The worldwide prevalence

of IBS based on the Rome IV criteria is 3.8% (95% CI 3.1 – 4.5), which is substantially lower than based on the Rome III criteria (9.2; CI 7.6–10.8) [23]. Four AWS met the Rome IV criteria for IBS, which is 5.1% of the sample. Of those 4, there were 3 women and 1 man, thus the prevalence for women was 13.6%.

**Table 1:** Average scores for trait anxiety, visceral anxiety, and anxiety sensitivity for AWS with and without IBS-like symptoms, IBS patients and HC.

	N	Trait anxiety			Visceral anxiety			Anxiety sensitivity		
		M	SD	α	M	SD	α	M	SD	α
AWS w.o.	62	43.73	9.40	.90	6.92	7.89	.89	19.56	10.74	.88
AWS w.	17	52.35	8.26	.90	21.24	9.83	.88	32.20	13.56	.93
IBS	39	49.33	9.00	.90	27.33	16.04	.95	24.29	12.29	.89
HC	36	38.81	7.94	.89	4.56	4.95	.80	18.36	10.39	.90

AWS w.o. – adults who stutter without IBS-like symptoms; AWS w. – adults who stutter with IBS-like symptoms; IBS – irritable bowel syndrome patients; HC.- healthy controls.

**Data analysis**

Among AWS, we defined a group (n=17) which was experiencing IBS-like symptoms: they reported abdominal pain at least once per month, accompanied by at least one of the following: pain relieved after defecation, related to change in stool frequency or stool form.

To investigate the correlations between IBS symptoms and anxiety measures in AWS Pearson’s correlation coefficient was calculated for the entire AWS group.

To explore differences in anxiety between AWS with and without IBS-like symptoms, IBS patients, and HC, three regression analyses were performed with anxiety measures as criterion variables, and sex, age, and group (AWS with and without IBS-like symptoms, IBS patients, and HC) as predictor variables. Age was

IBS symptoms questionnaire is a 6-item measure based on the Rome III criteria and measures how often symptoms are experienced. The total sum was used as a measure of IBS-like symptoms in AWS. The average values for each questionnaire are presented in Table 1.

centered to the group median (C=28). Categorical variables were dummy coded with males and AWS without IBS-like symptoms as referent categories. Also, 95% confidence intervals of estimated parameters were calculated using bootstrapped samples (N of samples =5000).

**Results**

**Correlations**

Correlations between stuttering severity, IBS symptoms, trait anxiety, visceral anxiety and anxiety sensitivity in AWS are presented in Table 2. Stuttering severity had no significant correlations with any of the measures. Correlations between IBS symptoms and all three measures of anxiety were significant and positive, as were the correlations among the anxiety measures.

**Table 2:** Correlations between anxiety measures, stuttering severity, and IBS symptoms in AWS.

Variable	1	2	3	4
1. Stuttering severity	/			
2. IBS symptoms	.02	/		
3. Trait anxiety	-.09	.35**	/	
4. Visceral anxiety	-.09	.54***	.51***	/
5. Anxiety sensitivity	-.12	.31**	.58***	.65***

\*p<.05; \*\*p<.01; \*\*\*p<.001

**Group comparisons**

In order to control possible effects of age and gender, for each regression analysis age and gender were entered in the null model, while group was entered in model 1. Results of the regression analyses are presented in Table 3.

There was a significant effect of group on trait anxiety. AWS with IBS-like symptoms had higher trait anxiety scores than AWS without IBS-like symptoms and HC. AWS without IBS-like

symptoms also had higher scores than HC. There was a significant effect of group on visceral anxiety. AWS without IBS-like symptoms did not differ from HC, but they both had lower scores than IBS patients and AWS with IBS-like symptoms. There was no difference in visceral anxiety between IBS patients and AWS with IBS-like symptoms. Also, there was a significant effect of group on anxiety sensitivity. The only difference was found between AWS with and without IBS-like symptoms. AWS with IBS-like symptoms had higher scores than AWS without IBS-like symptoms.

**Table 3:** Results of Hierarchical Regression Analyses for trait anxiety, visceral anxiety, and anxiety sensitivity (With Bootstrap Confidence Intervals).

Model	Predictors	B	SE	t	95% CI		ΔR <sup>2</sup>	R <sup>2</sup>
					Lower	Upper		
<b>STAI</b>								
H <sub>0</sub>	(Intercept)	42.94	1.14	37.54***	40.77	45.17		
	Age	-0.24	0.12	-2.01*	-0.46	-0.03		
	Gender (F)	4.42	1.60	2.76**	1.22	7.50	.07**	.07**
H <sub>1</sub>	(Intercept)	43.14	1.24	34.65***	40.57	45.74		
	Age	-0.10	0.12	-0.87	-0.35	0.14		
	Gender (F)	4.55	1.65	2.76**	1.43	7.73		
	AWS and IBS	5.88	2.48	2.37*	1.23	10.58		
	IBS	3.06	2.15	1.42	-1.81	7.51		
	HC	-7.25	2.17	-3.34**	-11.37	-3.08	.20***	.27***
<b>VSI</b>								
H <sub>0</sub>	(Intercept)	9.62	1.60	6.02***	7.48	12.19		
	Age	-0.06	0.17	-0.33	-0.38	0.28		
	Gender (F)	6.88	2.25	3.06**	2.67	11.12	.06*	.06*
H <sub>1</sub>	(Intercept)	6.18	1.46	4.24***	4.01	9.08		
	Age	-0.16	0.14	-1.10	-0.45	0.13		
	Gender (F)	2.49	1.96	1.27	-0.97	6.35		
	AWS and IBS	12.86	2.97	4.33***	7.71	18.80		
	IBS	19.21	2.56	7.52***	13.74	24.59		
	HC	-2.88	2.58	-1.12	-6.98	0.76	.41***	.47***
<b>ASI</b>								
H <sub>0</sub>	(Intercept)	19.21	1.44	13.37***	16.57	22.16		
	Age	-0.33	0.15	-2.22*	-0.60	-0.06		
	Gender (F)	4.97	2.03	2.45*	0.73	9.06	.06*	.06*
H <sub>1</sub>	(Intercept)	18.66	1.59	11.73***	15.50	22.18		
	Age	-0.22	0.16	-1.39	-0.59	0.10		
	Gender (F)	3.60	2.31	1.56	-0.23	7.74		
	AWS and IBS	10.30	3.43	3.01**	2.74	17.74		
	IBS	3.34	3.10	1.08	-3.14	9.05		
	HC	-2.12	2.86	-0.74	-7.03	3.39	.09*	.15***

\*p<.05; \*\*p<.01; \*\*\*p<.001; STAI – trait anxiety; VSI – visceral anxiety; ASI – anxiety sensitivity; AWS – adults with stuttering; IBS – irritable bowel syndrome; HC – healthy controls.



## Discussion

The prevalence of IBS in this sample of AWS was 5.1%, which is in line with previous studies on HC, especially in young people. The worldwide prevalence for IBS based on a meta-analysis was 3.8% [23] while a recent worldwide study [24] which included 24 countries reported the same overall prevalence (3.8%), with a slightly higher prevalence in women (4.8%) and in the age group 18-39 (4.9%). In this study the prevalence of IBS in women was 13.6%, which is much higher than previously reported. Considering the relatively small number of AWS in this study, larger samples should be examined before drawing conclusions.

Stuttering severity was not significantly related to any anxiety measure, or IBS symptoms. Previous studies have also shown that anxiety and stuttering severity are not related [2]. This is supported by findings that a reduction in anxiety will not lead to a reduction in stuttering severity, although it may improve QoL [7]. The lack of correlation between stuttering severity and anxiety further supports the hypothesis that anxiety is in fact a consequence of experiences with stuttering, rather than a cause of stuttering, in line with Iverach et al [2].

Another possible explanation for the lack of these correlations is that the measure which was used for stuttering severity did not have enough variability and thus no correlation could be found with other variables. On the other hand, IBS symptoms in AWS were significantly related to all anxiety measures, which is in line with previous research on IBS. Different aspects of anxiety, such as trait anxiety and visceral anxiety, are considered key components in IBS symptom generation. Contrary to stuttering, anxiety seems to have a causal role in IBS [9]. Psychotherapy in IBS patients results not only in QoL improvement, but in a significant reduction of bowel symptoms [25]. Overall, it seems that IBS symptoms are relevant for different aspects of anxiety even in AWS.

When comparing AWS with and without IBS-like symptoms, IBS patients, and HC, we found significant differences in all anxiety measures. Specifically, we found that AWS with IBS-like symptoms had higher trait anxiety, visceral anxiety, and anxiety sensitivity than AWS without IBS-like symptoms. For trait anxiety, we also found that HC had significantly lower scores than all other groups, while IBS patients had similar scores as AWS with IBS-like symptoms. It seems that IBS-like symptoms have an additional impact on the psychological functioning of AWS, over and above the burden of stuttering. It should be pointed out that AWS with and without IBS-like symptoms and IBS patients all have anxiety levels which are considered clinically significant and as such would benefit from psychological treatment. For example, patients suffering from physical illnesses have average anxiety levels of 41.91 (SD=12.70), while psychiatric patients suffering from anxiety symptoms achieve a score of 48.08 (SD=10.65). Thus, AWS without IBS-like symptoms show anxiety levels similar to patients with physical illnesses, while AWS with IBS-like symptoms and IBS patients show levels comparable to those found in anxious psychiatric patients. HC in this study had similar levels of trait anxiety as a normative sample of females aged 19-39 (M=36.15; SD=9.53) [19].

Anxiety sensitivity was also higher in AWS with IBS-like symptoms. Anxiety sensitivity has been related to anxiety pathology, and is considered a personality trait, separate from trait anxiety. While trait anxiety measures the predisposition for anxious reactions in general, anxiety sensitivity refers to more specific worry and fear of one's own anxiety symptoms [9]. While AWS without IBS-like symptoms and IBS patients have similar values to those of chronic pain patients (M=20.30; SD=14.50), AWS with IBS-like symptoms have a higher average score [26], both still substantially lower than scores of patients suffering from anxiety disorders (M=42.45; SD=11.37) [27]. Since anxiety sensitivity is significantly different among AWS who differ in their IBS-like symptoms, it is possible, that IBS symptoms lead to an increased fear of bodily sensations, a main characteristic of IBS.

The final aspect of anxiety – visceral anxiety – is considered specific to GI-related disorders, as it measures GI-related cognitions, affect and behaviour, which are a result of fear of GI sensations and the context in which they occur [9]. Thus, it is quite expected that IBS patients had the highest scores and AWS without IBS-like symptoms and HC had the lowest scores with no difference between them. What is interesting and somewhat unexpected is that, compared to those in IBS patients, VSI scores were not significantly lower in AWS with IBS-like symptoms, even though they do not have a formal diagnosis of IBS, nor do they meet the diagnostic criteria. This could imply that stuttering somehow facilitates fear of GI sensations and social situations in which they occur, as measured by the VSI. Even though AWS with IBS-like symptoms have milder and fewer symptoms than IBS patients, they are quite sensitive to social cues and possible social consequences of such symptoms. Perhaps this can be explained by a heightened social sensitivity AWS has, which often results in social anxiety. As described by some authors, AWS develop social anxiety because of their negative social experiences [2], which may lead to a higher social sensitivity. Perhaps this social sensitivity heightens their fear of embarrassment in social situations, which is then reflected in the score we obtained on visceral anxiety.

## Clinical implications

These findings are based on data from a clinical sample of AWS seeking treatment for stuttering, and IBS patients receiving treatment as outpatients. Results indicate that anxiety characteristics are more pronounced in AWS with IBS-like symptoms compared to AWS without such symptoms and HC. Even though AWS without IBS-like symptoms also had higher anxiety than HC, AWS with IBS-like symptoms had scores which are considered clinically significant. Although stuttering severity was not related to any anxiety measure, it could be concluded that in AWS with severe anxiety further investigation of symptoms is warranted. This population might benefit not only from speech therapy, but also psychological treatment. It has been suggested that psychological treatment should be offered in combination with speech therapy or prior to it, to address specific factors related to elevated anxiety, which probably involve interpretations and expectations relating to social situations [2,5]. Social situations are also relevant for IBS [9].

which is partly evident from high levels of visceral anxiety in these patients. Although IBS was not diagnosed in this subsample of AWS, and their symptoms do not fully meet the IBS criteria, their visceral anxiety was not different from levels found in IBS patients with a formal diagnosis. This once again underlines the possible role of social situations in psychological functioning of AWS (with IBS-like symptoms) and the possible benefits of addressing it in therapy.

### Limitations

The correlational nature of the study prevents us from making any causal conclusions. We can only speculate on the role of anxiety in stuttering. We can only observe that AWS with IBS-like symptoms have higher levels of anxiety, but if that is a consequence of IBS-like symptoms or a result of another factor, we cannot be sure. Even though there were 154 participants in the study, the numbers are small for each subgroup of participants. We have tried to mitigate this limitation by using bootstrapped confidence intervals but having a larger sample would allow for higher validity of data. Finally, participants with stuttering and those with IBS were recruited after seeking help for their conditions, which limits the generalizability of our results to health-seeking persons.

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#### Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committees of Clinical Hospital Sv. Duh Zagreb (January 25th, 2018.; Reg. No. 01-384) and Clinical Hospital Centre Rijeka (February 6th, 2018.; Class 003-05/18-1/11, Reg. No. 2170-29-02/15-18-2).

#### Consent to participate

Informed consent was obtained from all individual participants included in the study.

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