RESEARCH ARTICLE

Investigating the association between generalized anxiety symptoms and social and communication impairments of autistic youth

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Abstract

Background: Past research has found that overall anxiety and social anxiety symptoms are associated with the occurrence of social and communication challenges within autistic populations. **Objective:** The aim of this study was to determine whether generalized anxiety disorder symptoms were associated with social and communication symptoms in autistic youth. **Method:** The cross-sectional sample was comprised of 253 autistic youth aged 8-18 (196 Males, 57 Females). Participants were divided in a child (Grade 3-8) group and an adolescent (Grade 9-12) group. A hierarchical linear regression analysis was conducted to evaluate whether the generalized anxiety score predicted the social communication composite score, derived from the ADOS-2, after controlling for sex, grade level and expressive language ability. **Results:** Correlation analyses showed an association between social communication ability and general anxiety disorder symptoms in the child group such that those with greater anxiety had fewer social communication symptoms. However, after controlling for sex, grade, and language ability, general anxiety disorder symptoms did not predict social communication difficulties in either children or adolescents. **Conclusions:** Alongside past literature, these findings suggest that the different types of anxiety disorders may have differential impacts on autistic youth's social and communication symptoms. Further research should investigate whether other anxiety subtypes affect autistic youth's social and communication symptoms.

Key Words: generalized anxiety, autism spectrum disorder, social communication impairments, verbal ability, anxiety

According to a meta-analysis, approximately 40% of autistic [1] youth, under the age of 18 have a co-occurring anxiety disorder, which include social anxiety disorder, separation anxiety disorder, and generalized anxiety disorder [2]. This may be a higher prevalence than is seen in neurotypical youth, for example, a prevalence of 31.9% for anxiety disorders was reported for a sample of 13-18-year-olds [3,4]. Several studies have investigated the presence of co-occurring anxiety disorders within autistic youth and their relationship with core autism symptomatology [2-3,5-7]. However, there are discrepancies within the autism

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literature as to whether anxiety is associated with more severe core autism symptoms in autistic youth [3,5,8-10].

Co-occurring anxiety may have harmful effects on the autistic youth's overall well-being. Greater severity of anxiety symptomatology within autistic youth is associated with reductions in participation in the home, community, and school environments [11]. Social withdrawal from school or the community can lead to inadequate exposure to social environments [11]. Chang and colleagues state that co-occurring anxiety in autistic youth raises the concern of impaired social functioning that can carry through to the child's adult life [3]. Thus, untreated anxiety within autistic youth may have long-standing harmful social outcomes [2].

Age Differences in Anxiety in Autism

The severity of anxiety symptoms within autistic individuals has been found to vary by age [6,7]. Past research has found that autistic adolescents report higher rates of anxiety at a clinically diagnostic level than autistic school-aged children [6]. In agreement with the above research, a meta-analysis by van Steensel and Heeman found that anxiety symptom severity in autistic children increased with age [12]. Further, the severity level of anxiety symptoms of autistic youth was significantly higher than a sample of neurotypical youth who also presented with clinical levels of anxiety [12]. These authors attributed the gradual increase of anxiety in part to an increase of self-awareness and worry that comes with age, as well as environmental factors such as bullying, awareness of social norms, and an increase in social demands [12].

When analyzing different sub-types of anxiety across development in autistic youth, Varela and colleagues reported that autistic children (ages 6-11) presented more generalized anxiety symptoms than adolescents (ages 12-18), while the adolescent group presented more social anxiety symptoms than the younger group of autistic children [7]. These findings are consistent with an older study by Weems and Costa that found a higher prevalence of generalized anxiety presentations in neurotypical youth aged 10-13 compared to an adolescent group aged 14-17, and a higher prevalence of social anxiety in the adolescent group compared to their younger peers [13].

Anxiety and Social and Communication Impairments in Autistic Youth

Duvekot and colleagues found that overall anxiety symptoms were associated with greater social and communication difficulties within their autistic sample [5]. Hallet and colleagues found similar results when examining subtypes of anxiety disorders [14]. They found that parents of autistic children with clinical levels of separation anxiety and social anxiety reported greater social and communication impairments than those without [12]. When specifically examining social anxiety in autistic youth, Chang and colleagues reported that autistic children with more severe social anxiety had higher levels of social functioning impairments [3]. Further, Sukhodolsky and colleagues found that increased overall anxiety was associated with impairments in social reciprocity [9].

However, other research has not found this relationship. Within a longitudinal study, Teh and colleagues found that within their sample of 5-17-year-old autistic children, social and communication impairments at time 1 of the investigation did not predict anxiety scores at time 2, which was 10-19 months after the initial investigation [10]. Moreover, anxiety scores at time 1 did not predict social and communication difficulties at time 2. While Teh and colleagues reported nonsignificant results, Eussen et al. found that milder core autism symptoms were associated with greater anxiety symptoms [8,10]. They proposed that this association may be due to an increased social awareness within autistic youth with fewer support needs and the greater desire of these youth to fit in socially with peers as they get older [8]. Due to these significant discrepancies in past research, Varela and colleagues stress the importance of further research that considers the shift in anxiety severity across development and its effect on the presentation of anxiety and autism symptoms at different points in time [7]. Understanding the profiles of autistic youth with anxiety disorders may help inform different clinical, social, and school intervention programs that can target the specific needs of autistic youth.

Current Study

Past research has looked at the effect of social anxiety, separation anxiety and anxiety more broadly on the social and communication skills of autistic youth [3,7,8,10]. While some research has examined generalized anxiety, this research has been conducted on a clinical sample that was not representative of the broader ASD population [7,14], whereas our research was conducted with a community sample. Chang and colleagues also investigated generalized

anxiety, but their research is reflective of a limited sample of autistic youth all with fluent speech [3]. Thus, as far as we are aware, research has yet to examine the association between generalized anxiety disorder and social and communication skills of autistic youth amongst different age groups and verbal ability levels, using a community sample.

The current study aimed to determine whether generalized anxiety disorder symptoms were associated with the degree of social communication impairments in autistic children and adolescents. We hypothesized that higher generalized anxiety symptoms would be associated with greater social and communication difficulties in autistic youth; both in the child group (grades 3-8) and the adolescent group (grades 9-12).

Method

Participants

The data within this study were collected through the Province of Ontario Neurodevelopmental Disorders (POND) database. Participants with neurodevelopmental disorders were recruited to participate in a comprehensive battery of assessments to gain insight into the neurobiology, behaviour, and cognition of children with various neurodevelopmental disorders. Parents of the participants also completed a range of interviews and questionnaires. There are POND network testing sites across Ontario in the cities of Hamilton, Toronto, Kingston, and London. Child assent and informed parental consent was granted by all participants. All sites received approval from their respective ethics boards.

Two-hundred and fifty-three participants who were enrolled with the POND network met the inclusion criteria of this study. The sample was comprised of autistic youth aged 8-18 (196 Males, 57 Females). To be included within the study, participants needed to have completed the Autism Diagnostic Observation Schedule-2 (ADOS-2; [15]), the Oral and Written Language Scale (OWLS; [16]), and the Revised Child Anxiety and Depression Scale (RCADS; [17]). All the included measures were completed at the same time and were administered by a trained research assistant. Participating youth ranged from grades 3-8 (M = 5.45, SD = 1.61) and grades 9-12 (M = 10.52, SD = 1.1). Participants were divided into two groups based on their grade level in accordance with the Ontario provincial school system: Grades 3-8 and Grades 9-12. We chose to break the participants up this way as the anxiety measure is scored based on grade, and we propose that this makes for a natural developmental split of the participants.

When considering demographic information, 79% of the participants identified their ethnicity as white, and 34% as non-white (participants could endorse more than one option. Of the participants, 20% reported a comorbidity of ADHD and 40% of the participants have diagnosed medical co-morbidities such as asthma and epilepsy. Further information on ethnicity, comorbidity and household income statistics can be found in Table 1.

Measures

OWLS-II Oral Expression Score

The Oral and Written Language Scale is a measure that evaluates the receptive and expressive language skills of youth and young adults ranging from 3 through 21 years of age [16]. The OWLS-II test has four different subscales: a) listening comprehension, b) oral expression, c) reading comprehension and d) written expression. The composite subscale score is used to provide information on a student's performance in a particular area of language [16]. For this study, the oral expression composite score (subsequently referred to as "OWLS - oral expression"), with age equivalency based on year, was used to control for expressive language ability. The items were measured through spoken responses to oral and pictorial prompts provided by the administrator. The OWLS-II oral expression measure contains 106 items scored as followed: 0 (Incorrect), or 1 (Correct). Additionally, the administrator would indicate whether the response was: P (Preferred), A (Acceptable), or – (Missing Response). The oral expression has a split-reliability of 0.94-0.96, depending on age [16]. The factor structure of the OWLS and the correlations between factors reflect its validity [16].

Revised Child Anxiety and Depression Scale – Parent Version

The Revised Child Anxiety and Depression Scale – Parent Version (RCADS-P; [17]) was used to assess participants' anxiety. The RCADS-P is a 47-item parent-report form. Parents were asked to rate all items using a 4-point scale that ranged from 0-3 with the ratings being as follows: 0 (Never), 1 (Sometimes), 2 (Often), and 3 (Always). The RCADS is comprised of six subscales: social anxiety, specific phobia, major depression, generalized anxiety, separation anxiety, and obsessive-compulsive behaviour. The current study used the 7-item generalized anxiety subscale T-score in isolation. The severity and presence of generalized anxiety increases with higher t-scores on the RCADS-P. The RCADS-P is regarded as a valid and reliable measure for determining the severity of anxiety and depression within autistic youth, as internal reliability on the subscales ranged from 0.72-0.93 and the measure correlated with two other measures of anxiety [18].

Table 1. Demographics– ethnicities, comorbidities and household income of sample of autistic youth and their household (N = 253)	
Demographic Characteristics	%(n)
Ethnicity[1]	
White	79.4 (201)
Black	7.1 (18)
South Asian	4.3 (11)
Indigenous Canadian	4.3 (11)
Chinese	4.3 (11)
Hispanic	4.7 (12)
Jewish	3.6 (9)
Filipino	2.8 (7)
Unlisted Ethnicities	3.6 (9)
Other	3.6 (9)
Comorbidities[2]	
Medical Co-morbidities	39.5 (100)
ADHD	20.2 (51)
Anxiety	13.5 (30)
Learning Disability	11.9 (23)
Intellectual Disability	1.6 (4)
Social Phobia	0.4 (1)
Obsessive Compulsive Disorder	2.8 (7)
Speech/Language Delay	0.8 (2)
Auditory Processing Disorder	1.6 (4)
None	16.2 (41)
Household Income	
Less than $10 000	7.5 (19)
$10 000-$24 99	4.7 (12)
$25 000-$49 999	10.7 (27)
$50 000-$74 999	11.8 (30)
$75 000–$99 999	11.8 (30)
$100 000–$149 999	15.8 (40)
$150 000–$199 999	11.5 (29)
$200 000 or more	8.7 (22)
Prefer not to answer	12.3 (31)
Unsure	5.1 (13)

[1]For ethnicity and comorbidities, participants could endorse more than one option.
[2]Medical co-morbidities include asthma, epilepsy and Fragile X syndrome among other rarer conditions.

Autism Diagnostic Observation Schedule – Second Edition

The Autism Diagnostic Observation Schedule (ADOS-2; [15]) is a semi-structured and standardized measure. The ADOS-2 is comprised of subscales that measure communication, social interactions, play/imagination and restricted and/or repetitive behaviours. There are four modules within

the ADOS-2 that are administered based on the verbal level of the participant. Module 1 is designed for testing children with none to inconsistent phrase speech. Module 2 is designed for testing children with minimal verbal ability (few to no words and phrases), while Modules 3 and 4 were designed for testing children and adolescents who are verbally fluent [19]. This study reports on participants who were assessed using any of the four ADOS-2 modules. This study uses the total social affect algorithm scores from module 1 to 4, which are composed of the communication and reciprocal social interaction scores. Higher scores on the algorithm scores indicate greater social and communication impairments [15].

Data Analysis

Analysis was conducted in SPSS Statistics version 29. Descriptives were calculated, and correlations between all of the variables of interest were conducted. Hierarchical regression analyses were used to explore whether generalized anxiety score, derived from the RCADS-P, were associated with social affect scores, derived from the ADOS-2, while controlling for sex, grade level and expressive language age within the model. A separate hierarchical linear regression was conducted for both age groups: children and adolescents. Before running the hierarchal linear regression, the data were assessed for any violations of the following assumptions: linearity, multicollinearity, homoscedasticity, normality, and the independence of residuals; all assumptions were met. Finally, there were no detected outliers that biased our model and the Cook's Distance values were all under 1.

Results

Descriptive Data

As shown in Table 2, the majority of the child participants were administered Module 3 of the ADOS-2, while the majority of the adolescent participants were administered Module 4 of the ADOS-2. The mean grade level in the child group was grade 5 and the mean grade level of the adolescent group was grade 11. See Table 2 for further information on the descriptive statistics of the variables of interest.

As shown in Table 3, in the child group, there were significant relationships between the OWLS oral expression score and the ADOS-2 social affect score, indicating that lower oral language abilities are associated with more severe social communication symptoms. There were significant positive relationships between the OWLS oral expression score and the RCADS generalized anxiety score, and grade level, respectively. This indicates that

Table 2. Descriptive statistics for total by age group for ADOS-2[1] scores, OWLS[2] Oral Expression Score, RCADS[3] generalized anxiety scores

	Child (Grade 3- 8) (N = 170)	Adolescent (Grade 9-12) (N = 83)
	%(n)	%(n)
# Male	78.8 (134)	74.7 (62)
ADOS Module		
1	7.6 (13)	4.8 (4)
2	9.4 (16)	7.2 (6)
3	74.7 (127)	18.1 (15)
4	8.2 (14)	69.9 (58)
	Mean (SD)	Mean (SD)
Grade Level	5.39 (1.61)	10.52 (1.12)
Social Affect score	10.14 (4.51)	11.65 (4.11)
OWLS – Oral Expression Score	8.06 (3.92)	11.53 (6.10)
Generalized Anxiety T-score	53.40 (13.90)	54.07 (14.56)

[1]Social Affect Score derived from the Autism Diagnostic Observation Schedule-2

[2]Oral Expression Score Language Age Equivalent derived from The Oral and Written Language Scale-II Expression Score,

[3]Generalized Anxiety Score derived from The Revised Child Anxiety and Depression Scale – Parent Version

Table 3. Correlation Matrix: Relationships between variables of interest in children

		1	2	3	4	5
1	Sex	1				
2	Generalized Anxiety T-Score	0.02	1			
3	Grade Level	0.06	-0.03	1		
4	OWLS -Oral Expressive Score	0	.19*	.24**	1	
5	Social Affect Score	-0.14	-.19*	0.01	-.32**	1

** Correlation is significant at the 0.01 level (2-tailed),

* Correlation is significant at the 0.05 level (2-tailed).

Point-biserial correlations are used for all correlations involving the categorical variable sex (female = 1, male = 0)

higher oral language abilities are associated with more severe generalized anxiety symptoms. As well, older grade levels are associated with greater oral language abilities. Additionally, a significant correlation was found between the RCADS score and the ADOS-2 score, indicating that those with higher anxiety levels had fewer social communication symptoms.

In the adolescent group (see Table 4) there were also a number of significant correlations. This group showed a significant correlation between grade and ADOS-2, indicating that with increased grade level, social communication symptoms increased. Language abilities as measured by the OWLS Oral expression score were correlated with sex, (such that females had higher language scores), ADOS (such that those with higher language scores had fewer social communication symptoms) and generalized anxiety, such that those with better language ability had higher levels of generalized anxiety.

Hierarchical Linear Regression

Two separate hierarchical multiple regression analyses were conducted to explore whether generalized anxiety predicts social and communication skills in autistic children and

Table 4. Correlation matrix: relationships between variables of interest in adolescents					
	1	2	3	4	5
1 Sex	1				
2 Generalized Anxiety T-Score	0.09	1			
3 Grade Level	-0.13	-0.11	1		
4 OWLS -Oral Expressive Score	.36**	.32**	-0.08	1	
5 Social Affect Score	-0.13	-0.15	.28**	-.23*	1
** Correlation is significant at the 0.01 level (2-tailed),					
* Correlation is significant at the 0.05 level (2-tailed).					
Point-biserial correlations are used for all correlations involving the categorical variable sex (female = 1, male = 0)					

Table 5. Hierarchical multivariate linear regression analyses for predicting social affect score among autistic children							
	b	SE	β	t	F Change	R^2 change	R^2
Model 1					1.67		0.02
Sex	-1.5	0.83	-0.14	-1.83			
Grade	-0.05	0.21	0.02	0.21			
Model 2					21.99**	0.11	0.13
Sex	-1.57	0.78	-0.15	-2.02*			
Grade	0.28	0.21	0.1	1.33			
OWLS – Oral Expression	-0.4	0.09	-0.35	-4.69**			
Model 3					2.61	0.01	0.15
Sex	-1.55	0.78	-0.14	-1.99*			
Grade	0.25	0.21	0.09	1.2			
OWLS- Oral Expression	-0.37	0.09	-.32***	-4.28**			
Generalized Anxiety Score	-0.04	0.02	-0.12	-1.61			
Note. *p < 0.05. **p < 0.01.							
Sex = sex assigned at birth (female =1, male = 0)							

autistic adolescents after controlling for sex, grade level and expressive language ability.

Children

As shown in Table 5, Model 1, which controlled for sex and grade level, was not significant. Sex and grade level did not predict social and communication difficulties in autistic children. Two percent of the variance within the model was accounted for by sex and grade. Model 2, which added expressive language ability to sex and grade level, was significant, with male sex and higher expressive language ability predicting social and communication difficulties. An additional 11% of the variance within this model was accounted for by expressive language ability. Model 3, which added generalized anxiety scores to sex, grade level and

expressive language ability was significant, with sex and expressive language ability predicting social and communication difficulties. The generalized anxiety score did not predict social and communication difficulties in the autistic children. An additional 2% of the variance within the model was accounted for by the generalized anxiety score.

Adolescents

As shown in Table 6, Model 1, which controlled for sex and grade level was significant, with higher grade level predicting more social and communication difficulties. Model 1 accounted for approximately 9% of the variance in social and communication impairments. As shown in Table 6, Model 2, which added expressive language ability to sex and grade level, was not significant with expressive

Table 6. Hierarchical multivariate linear regression analyses predicting social affect score among autistic adolescents							
	b	SE	β	t	F Change	R² change	R²
Model 1					3.91*		0.09
Sex	-0.92	1.03	-0.1	-0.89			
Grade	0.99	0.4	0.27	2.51*			
Model 2					3.07	0.03	0.13
Sex	-0.25	1.09	-0.03	-0.23			
Grade	0.97	0.39	0.26	2.48*			
OWLS – Oral Expression	-0.13	0.08	-0.2	-1.75			
Model 3					0.35	0	0.13
Sex	-0.27	1.09	-0.03	-0.25			
Grade	0.95	0.39	0.26	2.40*			
OWLS – Oral Expression	-0.12	0.08	-0.18	-1.48			
Generalized Anxiety Score	-0.02	0.03	-0.07	-0.59			

Note. p < 0.05. * p < 0.01. **
Sex = sex assigned at birth (female =1, male = 0)

language explaining an additional 3% the variance. Model 3, which added generalized anxiety scores to sex, grade level and expressive language ability, was significant, with grade level predicting social and communication difficulties. The generalized anxiety score did not predict social and communication difficulties in autistic adolescents. Zero percent of the variance within the model was accounted for by the generalized anxiety score.

Discussion

Similar to other studies, we found no sex differences in social communication behaviours as measured by the ADOS [20]. Unlike previous findings that have found as students reach older grade levels, social and communication difficulties decrease, as generally social communicative symptoms improve over time [21], our study found a positive association between social affect and grade in adolescents, suggesting that social communicative symptoms may worsen over time. It is possible that for adolescents clinicians administering the ADOS expect more of these youth, and thus judge them more harshly on milder social communication symptoms. Indeed, the manual and training for the ADOS [15] does suggest that clinicians take the age of the testee into consideration when judging their impairment.

Perhaps unsurprisingly we did find a significant negative association between language ability and social communication scores in both children and adolescents, indicating

that those with greater language ability had fewer social communication symptoms. We also found a significant positive association between language ability and generalized anxiety symptoms, in both children and adolescents. This may be due to the fact that those with better language ability are simply more able to express their anxiety symptoms to their parents, who in turn are more likely to then report on them [22].

Unlike Teh and colleagues, who found no association between total anxiety scores and autism symptomatology over time [10], we did find a small but significant correlation between anxiety and social communication symptoms in the child group but not the adolescent group. Most of the research in this field has been conducted with social anxiety and social communication symptoms. Thus, it is possible that different anxiety disorders have unique effects on the social and communication difficulties of autistic youth, in that the nature of the worry or anxiety affects the child's social functioning. In sum, the findings are partially supportive of our hypothesis, as there was an association between generalized anxiety and social and communication impairments in autistic children but not autistic adolescents. Furthermore, generalized anxiety symptoms did not add any significant prediction to the regression equations predicting social communication symptoms in either autistic children or adolescents after controlling for sex, grade, and language ability.

Limitations

It is important to consider the limitations within the study. There is limited female representation in the sample, who may be misrepresented due to a possible sex bias. Recent research has found that autism symptoms in females may present differently than those in males, particularly those relating to social behaviours and social competences. For example, it was reported that autistic girls are more likely to mask their symptoms, meaning they intentionally copy the behaviours of those around them or supress their behaviours [23]. An instrument that is primarily designed on the male presentation of autism may inaccurately reflect the female population and their ability to meet the diagnostic cut-off.

Additionally, the instrument used to measure anxiety was created for a neurotypical population. Although the RCADS-P has shown to be valid and reliable for use with autistic populations, anxiety measures like the Anxiety Scale for Children - ASD (ASC-ASD; [24]) were designed to measure anxiety within autistic children. The ASC-ASD accounts for autistic characteristics that may not be present within the typical profile of anxiety in autism [24]. However, despite the creation of recent instruments that specifically investigate anxiety in autism, many researchers continue to use instruments that are normed on neurotypical populations, such as the RCADS [23], Spence Children's Anxiety Scale (SCAS; [25]), and the Child Behaviour Checklist (CBCL; [25-29]. A final limitation within this study is the solitary use of parent reports to measure generalized anxiety. Future research should include autistic youth's self-reports of their generalized anxiety symptoms.

Future Directions

Future research should further examine Intolerance of Uncertainty (IU) along with anxiety disorders. IU is a common characteristic of generalized anxiety disorder in both neurotypical and autistic populations. IU refers to a negative reaction to unpredictable events, such as social situations. Autistic youth have significantly higher levels of IU than neurotypical youth [30.31]. While IU and generalized anxiety are closely connected, Vasa and colleagues report that certain features of ASD, including severe social and communication difficulties, exacerbate experiences of IU [32]. Since IU is highly prevalent in autistic children, investigating generalized anxiety separate from other anxiety disorder subtypes provides further information on the impact that IU and other generalized anxiety symptoms have on the social skills of autistic youth [31]. Thus, since IU is a common experience among autistic youth and a common characteristic of generalized anxiety disorder, the current research may act as steppingstone for future studies that explore the relationship between IU, the subtypes of anxiety disorders and the social and communication abilities of autistic youth.

Future longitudinal research should evaluate the association between generalized anxiety symptoms and social and communication difficulties across autistic children's development into adolescence. Following autistic children who exhibit generalized anxiety symptoms at a young age could provide further insight into the shifting or stable presentation of anxiety and autism symptoms over time. Severe social anxiety disorder has been commonly found to be associated with greater social and communication challenges, but this study found no association between generalized anxiety and social and communication abilities in adolescents and after controlling for sex, grade, and language ability. Further research should compare the predictive utility of the different subtypes of anxiety disorders on social and communication difficulties in autistic youth.

Funding Declaration

Author Contributions

LZ conceived of this project, ran the data analyses, and wrote the manuscript under the supervision of EK. EA, JJ, RN and SG were responsible for overseeing of the data collection from the larger project from which this study was drawn. All authors approved of the manuscript.

Competing Interests: Dr. Anagnostou has received consultation fees from Roche and Quadrant, research funding from Roche, in-kind supports from AMO pharma, editorial Honoria from Wiley and book royalties from APPI and Springer. She holds a patent for the device, "Tully" (formerly Anxiety Meter). She has received royalties from APPI and Springer. The other authors have no competing interests to report.

Endnote

1. We use identity-first rather than person-first language in this paper as it avoids ableist language and is thought to be the general preference for the autism community.

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