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Communicative impairment in adolescents with Autism Spectrum Disorder (ASD): A comprehensive pragmatic assessment

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in social communication, repetitive behaviors and restrictive interests¹. Within social communication, pragmatics - the ability to use appropriately language and other expressive means in a given context²⁻³ - may be particularly impaired⁴.

Given the variability within the ASD spectrum, communicative difficulties in individuals with ASD fluctuate from stronger difficulties in specific aspects of language processes (lexical and syntactic) to deficit in pragmatic ability⁵. In this case, they do not necessarily show linguistic impairments, but may have difficulty with more sophisticated aspects, such as communicative-pragmatic ability⁶.

Difficulties in communicative-pragmatic ability have been shown for both verbal and nonverbal communicative acts⁷. As for non verbal modality, the difficulties concern with facial expressions, gestures and eye contact⁸. Verbal communication deficits include turn taking management⁹, topic maintenance and the ability to provide adequate and informative quantity of information¹⁰.

The majority of studies investigated the development of pragmatic communication and assessed performance in pre-school or school age¹¹⁻¹² while very few studies addressed the development of such ability in later stages e.g.,⁷.

Pragmatics is related to other cognitive skills, such as Executive Functions (EF) and Theory of Mind (ToM), even if the nature of such relationship is not totally clear (see e.g.,¹³⁻¹⁴). EF refers to a set of cognitive processes such as planning, shifting and working memory that allow goal-directed behaviors¹⁵; ToM is the ability to comprehend own and others' mental states¹⁶.

Individuals with ASD have difficulties in understanding the speaker's intention when it does not correspond to the literal meaning, and therefore they have difficulties in dealing with pragmatic phenomena such as indirect speech acts, humor and sarcasm¹⁷. Moreover, individuals with ASD often have problems in the behavioral regulation of executive processes such as planning, shifting, initiation and self-monitoring¹⁸⁻¹⁹.

As pragmatic difficulties may have an impact on ASD adolescents' social life²⁰ carefully assessing these aspects is crucial. Nevertheless, only a few clinical assessment tools with adequate psychometric properties are available²¹⁻²² and most of them are specific for school-aged children, e.g., Test of Pragmatic Language²³ or Pragmatic Rating Scale²⁴.

In light of this gap, the present research aims at providing a comprehensive communicative-pragmatic assessment in ASD using the Assessment Battery for Communication (ABaCo²⁵⁻²⁶), a validated clinical tool that allows to investigate several facets of pragmatic ability, both in comprehension and production. Furthermore, we expect differences both for the cognitive and ToM tasks performances between ASD and control group.

Moreover, the study aims to explore the relationship among pragmatics and other cognitive functions such as ToM and EFs, and to assess the role these latter have on the pragmatic performance in ASD. Specifically, we expect adolescents with ASD to exhibit pragmatic difficulties in all the aspects investigated by ABAco scales, in line with previous data on younger children⁷. Furthermore, we expect to find performance differences between ASD and control group in both cognitive and ToM skills. In particular, we expect adolescents with ASD to perform worse on all tasks examined.

Methods

Participants

A group (N=25) of adolescents with ASD will be enrolled based on the following inclusion criteria: (1) diagnosis of verbally fluent ASD, previously assigned by qualified clinicians using DSM-5 criteria; (2) adequate cognitive functioning: IQ \geq 80, as assessed by Raven's Standard Progressive Matrices Italian version²⁷; (3) adequate linguistic skills evaluated with the subtask for linguistic comprehension of the BVN12–18²⁸.

A control group (N = 25) of adolescents with typical development (TD) will be matched to the clinical group for age and gender. All participants will have to meet the following criteria: (4) native-Italian speakers; (5) age range 12-18 years; (6) none of them will have any previous history of brain damage or neurological disorders. Both participants and caregivers will provide informed written consent.

Material

Pragmatic assessment

- ABAco²⁵⁻²⁶, it is composed of 172 items divided in 5 scales. See the Table 1 for more details.

Cognitive assessment

A selection of items from the Neuropsychological Evaluation Battery, standardized in Italian for pre-adolescents and adolescents BVN 12–18²⁸:

- Token test²⁹
- Expressive vocabulary task³⁰
- Digit Span³¹
- Corsi block-tapping test³¹
- Immediate and Deferred Recall test for long-term verbal memory task³²⁻³³
- Selective attention³¹
- Tower of London³⁴
- Modified card sorting test³⁵

ToM assessment

- Sally and Ann task³⁶
- Strange Stories task³⁷
- Reading the Mind in the Eyes task³⁸

Procedures

Each participant will be tested in a quiet room, in two sessions of 1 h each. Recruitment will be held in collaboration with the Centro Riabilitazione Ferrero (Alba, Italy). Administration and coding procedures will be organized so that each ABaCo protocol will be coded by a different person than the one who administered it, in order to reduce any possible bias in the attribution of scores. Sessions will be video recorded to allow offline coding by blind raters. Administration and scoring procedures will be carried out according to the instructions provided in the standardized manual for each task.

Ability assessed	Tools	Description
Communicative-pragmatic assessment	<i>ABaCo</i> (Angeleri et al., 2012; 2015)	It assesses various aspects of the <i>pragmatic ability</i> , both in <i>comprehension</i> and <i>production</i> . It is composed of 172 items divided in 5 scales: linguistic, non-verbal/extralinguistic, paralinguistic, contextual, conversational. For each task can be assigned a score of 0 (incorrect answer) or 1 (correct answer).
	<i>Token test</i> (De Renzi & Faglioni, 1978)	It assesses <i>receptive language comprehension</i> . The score ranges from 0 to 36.
	<i>Expressive vocabulary task</i> (Brizzolara et al., 1994)	It assesses the <i>ability to name</i> items. The score ranges from 0 to 88.
	<i>Digit Span</i> (Bisiacchi et al., 2005)	It assesses <i>short-term verbal memory</i> . The score ranges from 0 to 9.
Cognitive assessment	<i>Corsi block-tapping test</i> (Bisiacchi et al., 2005)	It assesses <i>spatial working memory</i> . The score ranges from 0 to 7.

	<i>Immediate and Deferred Recall test for long-term verbal memory task</i> (Rapaport et al., 1968; Spinnler & Tognoni, 1987)	It assesses <i>the ability to extract and memorize information and recall it</i> , immediately after its presentation and after a short time has elapsed. The total score is separate for immediate and deferred task and ranges from 0 to 8.
	<i>Selective attention</i> (Bisiacchi et al., 2005)	It assesses the <i>ability to focus on a single or a few items</i> in a given perceptual field, for a certain amount of time. The score ranges from 0 to 21.
	<i>Tower of London</i> (Shallice, 1982)	It assesses <i>planning ability</i> . The score ranges from 0 to 12.
	<i>Modified card sorting test</i> (Nelson, 1976)	It assesses <i>shifting and inhibitory control</i> . The score ranges from 0 to 8.

Theory of Mind tasks	<i>Sally and Ann task</i> (Wimmer & Perner, 1983)	It assesses the <i>first-order ToM</i> . A score of 1 is given for correct interpretation, a score of 0 otherwise.
	<i>Strange Stories task</i> (Happé, 1994)	It assesses <i>advanced ToM</i> . A set of mentalistic stories constitutes the task. The six stories selected regard double bluff, mistakes, white lies, pretense, misunderstanding. The score ranges from 0 to 6.
	<i>Reading the Mind in the Eyes task</i> (Baron-Cohen et al., 2001)	It assesses <i>the ability to recognize complex mental states</i> as expressed by human eyes. The task assesses is composed by 28 pictures where only the eye region of the face is available. The total score ranges from 0 to 28.

Table 1. Assessment measures for the pragmatic, cognitive and ToM abilities with description

Approach for statistical analysis

The communicative-pragmatic performance of the two groups (ASD and controls), will be compared submitting their ABAco scores to a 2×5 repeated measures analysis of variance (ANOVA), with *Group* (ASD vs. control) as between-subjects factor and *Scale* (five levels: Linguistic, Extralinguistic, Paralinguistic, Context, Conversational) as within-subjects factor. Pairwise comparisons with Bonferroni correction will be used to examine the differences in scores on the ABAco scales.

To analyze differences in cognitive and ToM performance between participants with ASD and TD adolescents, we will perform a series of independent-samples T-tests for each cognitive task examined (i.e. memory, selective attention, working memory and cognitive flexibility). Then, we will apply Bonferroni correction for multiple comparisons.

To examine the relationship among pragmatic ability, ToM and EF, we will perform a correlation analysis (Pearson's R) among the scores on the ABAco (global scores and different scales) and ToM and cognitive task scores.

To further examine the role of relevant predictors, i.e. cognitive skills, EFs and ToM, on pragmatic performance, we will use Multilevel Regression models with global ABAco score. Before conducting the regression analyzes, we will check for collinearity between the predictors. We will then start by fitting a null model (intercept only), and then add each predictor (i.e. cognitive, EFs and ToM scores) using a stepwise forward procedure (model fit and model comparison is measured using the Akaike Information Criterion, AIC).

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