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Group-based educational interventions in young people with ASD without ID: a systematic review focusing on transition to adulthood

Raphaël Chancel

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THESE

Pour obtenir le titre de

DOCTEUR EN MEDECINE

Présentée et soutenue publiquement

par

Raphaël CHANCEL

Le 3 avril 2020

TITRE

Group-based Educational Interventions in young people with ASD without ID: A Systematic Review Focusing on Transition to Adulthood

Directeur de thèse : Professeur Amaria BAGHDADLI

JURY

Président : Professeur Amaria BAGHDADLI

Assesseurs : Professeur Amaria BAGHDADLI, Professeur Jorge LOPEZ CASTROMAN, Dr Emilie OLIE, Dr Stéphanie MIOT

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Abstract

Background: There is a growing number of young people transitioning to adulthood diagnosed with an autism-spectrum disorder (ASD). Among them, individuals without an intellectual deficiency have significant adaptive deficits and need individualized care and support services targeting better vocational, social, and educational outcomes. Group-based interventions, including patient education, social-skills training, and cognitive-behavioral therapy, are widely used in clinical settings to improve the daily life and outcomes of individuals who have ASD and face the challenge of transitioning to adulthood.

Methods: We performed a systematic review of studies concerning the efficiency of group-based educational interventions focusing on the transition to adulthood among young people with ASD with normal intellectual functioning.

Results: Following a systematic search, 21 studies among 163 were found to be eligible for inclusion. Stronger evidence was found for social-skills training and cognitive-behavioral therapy interventions.

Conclusion: Professionals should consider group-based psycho-educational intervention to be an appropriate and relevant service for young adults with ASD. Further research is needed on larger samples using a multicentric design to validate their efficiency before generalization.

Introduction

Rationnel

La prévalence des troubles du spectre de l'autisme (TSA) parmi les adultes est estimée à environ 1%, avec une grande hétérogénéité de fonctionnement intellectuel parmi les sujets. Durant les 20 dernières années, le nombre d'individus ayant un diagnostic de TSA a fortement augmenté et un grand nombre de ces personnes sont maintenant en transition vers l'âge adulte. Parmi cette population grandissante, la moitié, souvent dite « de haut niveau », possède des capacités intellectuelles normales. Il est démontré que, parmi les patients présentant un TSA, la présence de capacités intellectuelles normales peut-être associée à des déficits adaptatifs significatifs et des comorbidités tel que l'anxiété ou la dépression, qui ont souvent un impact négatif sur la qualité de vie et le fonctionnement global.

La transition vers l'âge adulte est particulièrement complexe, à la fois en raison de la dépendance persistante des jeunes adultes avec TSA à leurs aidants familiaux et de la perte fréquente d'accès aux prestations sociales auxquelles ils avaient accès enfants et adolescents. Les jeunes personnes avec TSA ont des résultats sociaux, scolaires et professionnels moins bon que celles avec un développement typique ou présentant d'autres troubles du neurodéveloppement. De plus, ces jeunes personnes avec TSA sont souvent sans emploi et, si elles ont un emploi, ont souvent un salaire plus bas. Enfin, de nombreux jeunes adultes avec TSA luttent contre des comorbidités psychiatriques, telles que la dépression et l'anxiété, altérant d'autant plus le fonctionnement global de ces personnes, déjà bas. Ces facteurs contribuent tous à des difficultés, dans cette population, à atteindre une indépendance sociale, financière et émotionnelle.

En conséquence, il est urgent de créer des interventions ciblant les jeunes personnes avec TSA sans déficience intellectuelle transitionnant vers l'âge adulte. L'objectif principal doit être d'améliorer le fonctionnement général et les résultats, en proposant à cette population un support efficace durant la période critique de transition vers l'âge adulte, tout en créant des opportunités. L'un des obstacles à cela est que très peu de recherches ont été réalisées sur la transition vers l'âge adulte des personnes avec TSA sans déficience intellectuelle (DI). En conséquence, notre connaissance des interventions efficaces pour les jeunes adultes TSA sans DI est encore limitée. Les recommandations internationales (NICE Clinical guideline [CG142]) suggèrent que les interventions devraient cibler le fonctionnement adaptatif et l'autonomisation, et qu'une attention particulière doit être portée sur les périodes de transition. En pratique clinique, les interventions de groupe ont été utilisées pour aider les jeunes individus avec TSA à comprendre leurs symptômes et à améliorer leur fonctionnement social.

Nombreuses de ces interventions sont basées sur les thérapies cognitivo-comportementales (TCC) ou utilisent les principes de l'éducation thérapeutique du patient (ETP) utilisée communément chez les personnes présentant des maladies chroniques (dont les troubles mentaux) afin d'obtenir une meilleure conscience des troubles, une formation et une autonomisation. Ces stratégies ont prouvé leur utilité dans un grand nombre de pathologies chroniques, telles que le diabète, étant ainsi considérées en France comme essentielles afin de construire n'importe quel plan de soin personnalisé pour les personnes avec des pathologies chroniques, y compris les TSA. En conséquence, un des challenges important est de valider l'efficacité de telles interventions avant leur généralisation.

Objectif

Dans ce papier, nous avons fait une revue systématique de l'efficacité des interventions éducationnelles de groupe utilisant la psycho-éducation, la remédiation cognitive, la TCC, la thérapie d'acceptation et d'engagement, l'entraînement aux habilités sociales ou l'ETP ciblant les besoins des jeunes personnes avec TSA sans DI en transition vers l'âge adulte.

Introduction

Rationale

The prevalence of autism-spectrum disorder (ASD) among young adults is estimated to be approximately 1%, with a large range of coexisting heterogeneous intellectual functioning [1]. In the past 20 years, the number of individuals diagnosed with an ASD has dramatically increased, with many of them transitioning to adulthood [2]. Among this growing population, one half, often labeled as high functioning, have normal intellectual capabilities [3]. It is known that normal intellectual functioning can be associated with significant adaptive deficits and comorbid conditions in ASD, such as anxiety or ADHD, which often have negative effects on quality of life and outcome [4].

The transition to adulthood is particularly challenging, due to both the remaining dependence of young ASD adults on their caregivers and the frequent loss of the social support they received during childhood and adolescence [5]. Young people with ASD have worse vocational, social, and educational outcomes than those with typical development or other developmental disorders [6,7]. In addition, they are often unemployed and earn a lower median salary when they are employed [8]. Finally, many young adults with ASD struggle with psychiatric comorbidities, such as depression and anxiety [9], worsening even more their already low functional outcomes. These factors all contribute to difficulties in their achieving independence, socially, financially, and emotionally [9].

As a result, targeting interventions towards young people with ASD without an intellectual deficiency (ID) who are transitioning to adulthood is an urgent matter. The main aim must be to improve their general functioning and outcomes by offering them effective support during the critical developmental period of the beginning of adulthood, while also creating windows of opportunity. One obstacle to such a plan is that little research has been conducted on the transition to adulthood of people with ASD without ID. Thus, our knowledge about effective interventions for young ASD adults without ID is still limited. International guidelines (NICE Clinical guideline [CG142]) suggest that interventions should target adaptive functioning and empowerment and that specific attention must be paid to transitions. In clinical practice, group-based educational interventions have been used to help young ASD individuals to understand their symptoms and improve their social functioning [10]. Many such interventions are cognitive-behavioral therapy (CBT)-based or use the principles of patient education (TPE) commonly used among people with chronic diseases (including mental health disorders) for a better awareness of their symptoms, training, and empowerment [11]. These strategies have been proven to be useful for a wide range of chronic conditions, such as diabetes [12], resulting in their being considered in France to be essential for building any personalized intervention plan for

individuals with chronic diseases, including ASD [13]. Thus, an important challenge is to validate the efficiency of such interventions before their generalization.

Objective

Here, we aimed to systematically review the efficiency of existing group-based educational intervention programs using psycho-education [14], cognitive remediation [15], CBT, acceptance and commitment therapy (ACT), social skills training (SST), or patient education [16] programs targeting the needs of young people with ASD without ID transitioning to adulthood.

Materials and Methods

Selection and Inclusion/Exclusion Criteria

We performed a literature search for articles published in English or French in PsycInfo-Esbco (Psycinfo, Eric, PsycARTICLES, Psychology and Behavioral Sciences Collection), PubMed, Web of Science (Web of Science™ Core Collection, KCI-Korean Journal Database, MEDLINE, SciELO Citation Index), and the Cochrane Library. The search was conducted in June 2019 and updated in January 2020, without limitation of the publication year. We followed the PRISMA standards, a 27-item checklist, and a four-phase process, including the identification, screening, eligibility, and inclusion of studies [17]. The search equation was: ((((((((((psychoeducation) OR "patient education") OR "group intervention") OR "intervention group") OR "behavioral therapy") OR "Cognitive behavioral therapy") OR "Cognitive enhancement therapy"))) OR ((transition) AND adulthood))) AND (((((((("ASD without intellectual disability") OR "autism without ID") OR "ASD without ID") OR "autism without intellectual disability") OR "autism spectrum disorder without intellectual disability") OR "high functioning autism") OR asperger)) AND (((efficacy[Title/Abstract]) OR effectiveness[Title/Abstract]) OR efficiency[Title/Abstract]) OR improve*[Title/Abstract]). The filters were Adolescent: 13-18 years and Young Adult: 19-24 years. This algorithm was applied to abstracts for PsycInfo-Esbco, all fields for PubMed, and title, abstract, and keywords for the Cochrane Library. Additionally, we searched the grey literature via Internet (Google and Google Scholar) using the same keywords as in the database search. The screening and selection process are presented in Fig.1.

The articles were read by two authors (AB and RC) and selected if they were consistent with the following inclusion criteria: the papers had to 1) be an original study documenting educational group-based intervention for people with ASD, which could include their families but not be targeted primarily towards them, including psycho-education (which can be defined as a systematic didactic

and psychotherapeutic intervention that aims to inform patients and relatives on a psychiatric disorder and improve their ability to cope with the illness) [14], patient education (which was defined as a systematic experience in which a combination or a variety of methods are used, possibly including the provision of information, advice, and behavioral modification techniques, that influence the way the patient experiences and perceives his illness and/or his knowledge and health behavior, aiming to improve, maintain, or learn how to cope with a condition, usually a chronic one) [16], cognitive remediation (which refers to nonpharmacological methods of improving cognitive function in people with severe mental disorders) [15], SST, ACT, or CBT focused primarily on AS core signs or associated psychiatric comorbidities (anxiety disorders, emotional dysregulation, depression); 2) study the effect of group-based intervention; 3) have a participant sample with a mean age between 13 and 26 years at study entry and a mean IQ over 70; 4) have a participant sample in which at least 50% of the participants had a diagnosis of an AS, including autism, ASD, atypical autism, Asperger Syndrome, or PDD-NOS (pervasive developmental disorder-not otherwise specified), according to ICD-10, DSM-IV, or DSM-5 criteria. Finally, papers were required to 5) have a minimum sample size of 10 participants.

The exclusion criteria were: 1) papers in which the chronological age, diagnosis, and/or intellectual level of their participants were not reported and 2) systematic reviews or meta-analyses.

Data Extraction

Two authors (RC, AB) read abstracts and selected them if they were broadly consistent with the inclusion criteria. If consensus was not reached, the abstracts were set aside for further evaluation. Then, these authors reviewed the full-text articles of selected abstracts against the inclusion criteria. Data were extracted from the full-text articles and reviewed, with regular discussions to ensure consistency. Data extraction from the full text was organized into the following sections: 1) group-based intervention (authors, type/ *e.g.* patient education or CBT, targeted population, short description), 2) information about each article (author(s), year, sample characteristics in terms of patients or their caregivers/sample size, age, cognitive level, gender, control groups), and 3) methodological quality of the study (outcome measures, control groups, randomization, well-described and manualized intervention, training of the therapist, comparability of the experimental and control groups, intervention delivered to the control group or waiting list, blind assessment, study of the long-term effect).

Data Analysis

The quality rating was made independently by the two authors (RC, FD) according to the PEDro Checklist [18], which is a scale used to measure the methodological quality of clinical trials. In cases of disagreement, the authors reached a consensus through discussion. The scale contains 11 items, each assessing a different source of bias. The 11 items are: (1) whether eligibility criteria were specified (selection bias), (2) whether subjects were randomly allocated to groups, (3) whether allocation was concealed, (4) whether the groups were similar at baseline concerning the most important prognostic indicators, (5) whether there was blinding of all subjects, (6) whether there was blinding of all therapists who administered the therapy, (7) whether there was blinding of all assessors who measured at least one key outcome, (8) measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups, (9) whether all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analyzed by intention to treat, (10) whether the results of between-group statistical comparisons are reported for at least one key outcome, and finally, (11) whether the study provides both point measures and measures of variability for at least one key outcome.

Studies scoring 9-11 on the PEDro scale were considered to be of excellent methodological quality. Scores ranging from 6 to 8 were considered to be of good quality, whereas studies scoring 4 or 5 were considered to be of fair quality and those scoring below 4 of poor quality.

Results

Study Selection

Of the 159 articles that were identified, 99 were rejected at abstract review and 60 available full texts were assessed. Among them, 43 did not meet the inclusion criteria, mainly in terms of age, IQ, small sample size, or because they targeted individual-based interventions. Finally, 17 papers were selected, comprising 16 studies. Searching the grey literature led us to include four additional studies. Of the 21 articles selected, one focused on a leisure program, eight on SST programs, three on cognitive remediation, seven on CBT, one on ACT, and one mixed all of them. Overall, 14 studies were randomized control trials (RCTs) and seven used other experimental designs.

A description of the interventions is presented in Table 2.

Risk of Bias Assessment

We examined the risk of bias according to the PEDro scale (Table 2). Overall, two studies were scored as excellent, 12 as good, five as fair, and one as poor. No study blinded the intervention to both patients and therapists and only six blinded the assessors.

Primary and Secondary Outcomes

On average, studies used four to five scales (from three to six) as their outcomes. These scales can be divided into 13 categories as follows: social skills/self-determination skills, adaptive and global functioning, work capabilities, neuro or social cognition, knowledge about asd, severity of asd, self-esteem, depression/anxiety, quality of life, therapeutic adherence and alliance, leisure capabilities, inattention, hyperactivity and impulsivity, and broad psychiatric measures. More details on the scales used can be found in Supplemental Data 1.

Descriptive Synthesis of Interventions

Social-Skills Training

Eight studies assessed the efficacy of SST programs [19-25].

Assessed Interventions: Four studies assessed [25,20,26,23] the efficacy of UCLA PEERS, a group-based caregiver-assisted intervention developed by Laugeson *et al.*, 2012 [26]. Two evaluated the original program designed for teenagers [25,26], whereas the other two evaluated a version adapted for young adults [23,20]. One study [19] evaluated SCI-Labor, an interpersonal problem-solving skills training group for adolescents and adults with Asperger Syndrome. One study assessed [21] START, a socialization intervention that blends experiential and instructional components with an emphasis on motivational elements and active involvement from participants and peer models. Another study [24] evaluated a group-based social skills intervention targeting three crucial functional domains: social communication, self-determination, and working with others. Finally, one study [27] assessed KONTAKT (Frankfurt SST), which focuses on learning to initiate conversation, understanding social rules and relationships, identification and interpretation of verbal and non-verbal social signals, problem-solving, coping strategies, and improvement of self-confidence in a group setting.

Sessions: UCLA PEERS comprised 14 to 16 weekly 90-min sessions, depending on the version. SCI-Labor consisted of 10 weekly 75-min sessions. START comprised 20 weekly sessions. The intervention of Nadig *et al.* [24] consisted of 10 weekly sessions. Finally, KONTAKT consisted of seven to 29 sessions, once to twice a week, according to the participants' age: adolescents had sessions

twice a week for a total of seven (“experienced adolescent”) or 15 (“naïve adolescent”) sessions, whereas children had sessions once a week for a total of 29 (“naïve children”) sessions.

Target Population and Diagnostic Criteria: The two studies assessing the efficacy of UCLA PEERS for young adults [20,23] recruited participants with a diagnosis of ASD without ID ascertained by healthcare professionals and the two studies [25,22] that assessed UCLA PEERS for adolescents targeted adolescents with a diagnosis of ASD without ID ascertained by a healthcare professional [22] or ADOS [25]. SCI-Labor targeted adolescents and young adults with a diagnosis of Asperger Syndrome, ascertained by ADI-R and ADOS. START targeted adolescents with ASD without ID ascertained using DSM-5 criteria. The intervention of Nadig *et al.* [24] targeted young adults with a diagnosis of ASD without ID, ascertained by ADOS or SCQ. Finally, KONTAKT targeted children and adolescents with a diagnosis of ASD without ID, ascertained by ADOS and ADI-R.

Study Design: Five studies [22,23,21,25,24] used a RCT design, whereas the studies conducted by Bonete *et al.* [19] and Herbrecht *et al.* [27] used an experimental design in which all ASD individuals received the treatment at the same time.

Control Condition: Five studies [22,23,21,25,24] compared their interventions to treatment as usual (TAU), whereas Bonete *et al.* [19] used a control group of typical individuals. Herbrecht *et al.* [27] did not include any control condition, instead opting for a pre-post comparison.

Primary Outcomes: The primary outcomes for both the studies of Gantman *et al.* [20] and Laugeson *et al.* [23] were severity of ASD measured by the SRS [28] and social skills measured by the SSRS [29]. Gantman *et al.* [20] also assessed loneliness, measured by the SELSA [30]. Laugeson *et al.* [23] also assessed empathy, measured by the EQ (a measure of ASD severity) [31], involvement in social get togethers, measured by the QSQ (a measure of social skills) [20], and young adults’ knowledge about autism, measured by the TYASSK [23]. Common primary outcomes for both the studies of Laugeson *et al.* [26] and Rabin *et al.* [25] were severity of ASD, measured by the SRS [28], and knowledge about ASD, measured by the TASSK [32] or TASSK-R [26]. Laugeson *et al.* [22] also measured social skills using the SSRS [29] and the frequency of hosted and invited get-togethers, measured by the QPQ [33]. Rabin *et al.* [25] also measured conversational skills by the CASS [34], loneliness by the LSDQ [35], empathy by the EQ [31], the frequency of hosted and invited get-togethers by the QSQ [20], and global social competence by the SSIS [36]. In the trial of Bonete *et al.* [19], the primary outcomes were interpersonal problem-solving skills, measured by the ESCI [37], adaptive functioning, measured by the VABS-II [38], and work capabilities, measured by the O-AFP

[39]. As the primary outcomes, Ko *et al.* [21] used three scales specifically developed for the study with no previous validation: questions asked (defined as the percentage of questions asked by the participant during conversation), positive facial expressions (defined as the percentage of time the participant displayed positive facial expressions), and mutual engagement (defined as the percentage of intervals in which both individuals contributed equally in a back-and-forth manner). Nadig *et al.* [24] used three primary outcomes: quality of life measured by the QoL-Q-A [24], self-determination measured by the SDS of the ARC [40], and social skills measured by the SPST [41,24]. Finally, Herbrecht *et al.* [27] used a total of seven primary outcomes: the DCL [42], which is a measure of the severity of ASD, the GAS [43], which is a measure of global functioning, the CGB [44], which is a measure of social skills, the PIA-CV-mini [45], which is also a measure of the severity of ASD, the SKS [46], which is another measure of social skills, the FaBel [47], which is a measure of the family burden caused by a mentally ill offspring, and finally, the FEG [48], which is a measure of social skills at school.

Main results: Laugeson *et al.* [22] found a significant group x time interaction for the SRS, SSRS, QPQ, and TASSK-R, thus demonstrating efficacy of the PEERS program. Overall, the study of Rabin *et al.* [25] showed a significant group x time interaction for all of their outcomes. In the study of Gantman *et al.* [20], the SELSA, SRS, and SSRS scores in the treatment group (TX) increased significantly more than those in the control group (DTC). Also, the SRS-social responsiveness scores decreased significantly more in the TX than DTC group, with significant improvements in social communication and decreased autistic mannerisms. In the trial of Laugeson *et al.* [23], the TX group showed significant improvement in the TYASSK, SRS, SSRS, and QSQ when comparing groups at the end of treatment, whereas there was no significant difference in the EQ. A greater reduction in ASD symptoms relating to social responsiveness on the SRS were also found in the TX than DTC group. Finally, Bonete *et al.* [19] found a significant improvement in socialization, measured by the VABS-S, and learning skills, measured by a subscale of the O-AFP. Ko *et al.* 2019 [21] demonstrated a significant group x time interaction for questions asked and positive facial expressions but not for mutual engagement. Nadig *et al.* [24] did not find any significant intervention effect. Finally, the results from the study of Herbrecht *et al.* [27] only showed significant or trend effects for the GAS, SKS, all subscales of the DCL, and two of six PIA-CV-mini subscales. There was no significant difference in the benefit of the program between the naïve and experienced adolescent groups. The “naïve children” group showed larger behavioural gains than the adolescent groups for some of the subscales.

Cognitive Remediation

The similarities between ASD and schizophrenia for social cognition issues [49] have led clinicians to adapt cognitive remediation treatment already widely used in schizophrenia to ASD patients. Three studies [50-52] assessed group-based intervention using cognitive remediation.

Assessed Interventions: In two studies, Eack *et al.* [50,51] assessed cognitive-enhancement therapy (CET), a group-based cognitive remediation program that targets social and non-social impairment (attention, memory, and problem-solving), whereas in the third study, Turner-Brown *et al.* [52] assessed social cognition and interaction training-autism (SCIT-A), a group-based social cognition therapy, of which the aim is to improve social cognition, social skills, and community functioning.

Sessions: CET was delivered over a period of 18 months and 45 sessions. SCIT-A included 18 weekly sessions.

Target Population and Diagnostic Criteria: All three studies targeted young adults with ASD without ID. The diagnostic criteria of ASD were the ADI-R or ADOS for both studies of Eack *et al.* [50,51], whereas Turner-Brown *et al.* [52] used only the ADOS.

Study Design: The 2018 study of Eack *et al.* used a RCT design, whereas all participants were in the experimental group in the 2013 study. Turner-Brown *et al.* [52] only initially used a RCT design as two participants were reassigned to the control condition.

Control Condition: CET was compared to enhanced support therapy (EST) in the 2018 study, which includes individual psychoeducation and supportive therapy, whereas the 2013 study had no control group, instead opting for a pre-post design. Finally, SCIT-A was compared to TAU.

Primary Outcomes: Primary outcomes in the first study of CET [50] were treatment satisfaction, measured by the CSQ-8 [53], neurocognition, measured by the MATRICS Consensus Cognitive Battery [54,55], and cognitive flexibility, measured by the WCST [56]. Primary outcomes for the second CET study [51] for ASD individuals were neurocognition, measured by the MATRICS Consensus Cognitive Battery [54,55], social cognition, measured by the MSCEIT [57] and Social Cognition Profile, and employment, measured by the Major Role Adjustment Inventory [58]. Primary outcomes in the study of Turner-Brown *et al.* were the perception of emotion, measured by the FEIT [59], ToM abilities, measured by the hinting task [60], and social functioning, measured by the SCSQ [61].

Main Results: The 2013 study of Eack *et al.* [50] found a significant improvement in neuro- and social cognition post-intervention relative to that pre-intervention. The 2018 study of Eack *et al.* [51] found a significant improvement in neurocognition in both groups, with larger effect sizes for the CET group. Participants treated with CET showed a rapid and significant differential increase in competitive employment at nine months, which remained significant at 18 months. Turner-Brown *et al.* found a significant group x time interaction for only the hinting task.

Cognitive Behavioral Therapy (CBT) and ACT (Acceptance and Commitment Therapy)-based Interventions

CBT and ACT are well-validated strategies commonly used to treat many psychiatric conditions, such as anxiety. Eight studies assessed the efficacy of group-based interventions using ACT or CBT.

Assessed Interventions: Hesselmark *et al.* [62] studied the effect of a group-based intervention using CBT and elements of dialectical and behavioral therapies, psychoeducation, social training, and cognitive-behavioral therapy. The study published by McGillivray *et al.* [63] evaluated the "Think well, feel well, and be well" intervention based on CBT and the targeting of depression and anxiety. Three studies [64-66] evaluated the multimodal anxiety and social skill intervention (MASSI). MASSI is a group-based intervention using CBT and targets anxiety and social disabilities. More specifically, Maddox *et al.* [66] focused on the long-term effects of MASSI, following the RCT of White *et al.* [65]. Pahnke *et al.* [67] evaluated an ACT-based group. Leung *et al.* [68] assessed CBT-CSCA (Adult), a CBT program that aims to teach social skills. Finally, Santomauro *et al.* [69] assessed a program called Exploring Depression, based on CBT.

Sessions: The program of Hesselmark *et al.* [62] consisted of 36 weekly 3-h sessions. "Think well, feel well, and be well" consisted of nine weekly sessions. MASSI consisted of 14 weekly sessions. The program of Pahnke *et al.* [67] consisted of 12 sessions, twice a week. CBT-CSCA consisted of 15 weekly sessions. Finally, Exploring Depression was composed of 11 sessions. The first 10 were organized once a week and the final and 11th session occurred four weeks after the 10th.

Target Population and Diagnostic Criteria: Three studies [69,62,68] targeted young ASD adults with associated depression and/or anxiety. The programs of Hesselmark *et al.* [62] and Leung *et al.* [68] targeted young adults with ASD without ID, whereas that of Santomauro *et al.* [69] targeted adolescents with ASD without ID. Three studies [63,67-69] relied on a previous diagnosis of ASD established by a healthcare professional. Murphy *et al.* [64] confirmed the diagnosis of ASD using the

ADI-R, Hesselmark *et al.* [62] using the ADOS, and Maddox *et al.* and White *et al.* [65,66] using both.

Study Design: All but two studies [63,68] used a RCT design. McGillivray *et al.* [63] assigned participants according to their alternating order of enrolment. Leung *et al.* [68] opted for a pre-post design.

Control Condition: Four studies [65,67,63,66] compared their programs to TAU, whereas that of Murphy *et al.* [64] used person-centered counselling and that of Hesselmark *et al.* [62], a recreational group. The study of Leung *et al.* [68] had no control group.

Primary Outcomes: Hesselmark *et al.* [62] used quality of life, measured by the QOLI [70], perceived comprehensibility, manageability, and meaningfulness of life, measured by the SoC scale [71], and self-esteem, measured by the RSES [72], as primary outcomes. The primary outcomes in the study of McGillivray *et al.* [63] were depression and anxiety, measured by the DASS [73], the frequency of cognitive self-statements associated with depressed mood, measured by the ATQ [74], and the frequency of cognitive self-statements associated with anxiety measured by the ASSQ [75]. In the study of Murphy *et al.* [64], the primary outcomes were anxiety, measured by the ADIS C/P [76] and the CASI-Anx [77], and severity of ASD symptoms, measured by the SRS [28]. White *et al.* [65] used the severity of ASD symptoms, measured by the SRS [28], anxiety, measured by the CASI-Anx [77], symptoms of separation anxiety disorder, social phobia, and generalized anxiety disorder, measured by the PARS [78], and global functioning, measured by the DD-CGAS [79], as primary outcomes. The primary outcomes in the study of Maddox *et al.* [66] were anxiety, measured by the ADIS C/P [76], severity of ASD, measured by the SRS [28], and loneliness, measured by the Loneliness Questionnaire [80]. Pahnke *et al.* [67] assessed stress-related behaviors, measured by the SSS [81], behavioral screening with the the SDQ [82], and anxiety, stress, and anger, measured by the BYI [83] subscales. The primary outcome in the study of Leung *et al.* [68] was social competence, as assessed by the MSCS-C [84]. Finally, in the study of Santomauro *et al.* [69], the primary outcomes were depression, anxiety, and stress, measured by the DASS [73], depression severity, measured by the BDI [85], and cognitive reappraisal and expressive suppression, measured by subscales of the ERQ [86].

Main Results: At the end of the study of Hesselmark *et al.* [62], the only outcome found to be significantly improved in the CBT group was QOLI. In the study of McGillivray *et al.* [63], the overall DASS and ASSQ improved over time, independently of treatment. However, focusing on participants

who scored above the normal range on the depression, anxiety, and stress subscales of the DASS and ATQ, they observed a greater significant decrease in depressive symptoms relative to that of participants on the waiting-list. Similar significant findings were observed for the DASS stress scores. No outcome showed significant improvement in the study of Murphy *et al.* [64]. Furthermore, no differences were observed between the experimental group and the controls, either in the self-ratings or teacher ratings with the SSS in the study of Pahnke *et al.* [67]. Concerning the self-ratings, a statistically significant group-by-time interaction was observed for the SDQ hyperactivity and pro-social behavior subscales. The significant group-by-time interaction effects indicated differences over time between the two groups in the teacher-ratings SDQ total score and the SDQ emotional symptoms and hyperactivity subscales. A group-by-time interaction effect was also observed for the BYI total scores. There were no statistically significant intergroup differences between the experimental group and controls for the BYI subscales. Leung *et al.* [68] found a significant improvement of parent and self-reports of the MSCS-C. Santomauro *et al.* [69] did not find a significant group x time interaction for the BDI or DASS. The same was true for both ERQ subscales. White *et al.* [65] found a significant group x time interaction on the SRS, but not the PARS or CASI-Anx. The MASSI participants showed significant improvement from pre- to post-treatment on the DD-CGAS. There was also a significant group difference on the DD-CGAS. For the CGI-I, 6 of 15 (40%) MASSI participants were rated as responders *versus* 3 of 15 (20%) of the waiting-list participants. Finally, Maddox *et al.* [66] showed that improvements in social skills, measured by the SRS, anxiety, measured by the ADIS C/P, and loneliness, measured by the Loneliness Questionnaire, were partially maintained one year after MASSI ended.

Multimodal Interventions

There was one study on multimodal interventions, which was a RCT that assessed ACCESS, published by Oswald *et al.* in 2018.

Assessed Interventions: ACCESS [87] was a CBT group-based intervention comprising SST, adaptive skills training, psycho-education, and a caregiver coaching group.

Sessions: The intervention consisted of 19 1.5-h weekly sessions

Target Population and Diagnostic Criteria: The study targeted young adults with a diagnosis of ASD without ID, ascertained by the ADOS.

Study Design: Oswald *et al.* [87] used a RCT design.

Control Condition: ACCESS was compared to TAU.

Primary Outcomes: The primary outcomes were social and adaptive functioning, measured by the ABAS-3, self-determination, measured by the Seven Component Self-Determination Skills Survey [88] and the Coping Self-Efficacy Scale [89], and anxiety, measured by the ASR [90].

Main Results: Overall, adaptive functioning of the participants improved significantly more in the ACCESS group, whereas an improvement in only the Performance score was observed concerning self-determination, measured by the SCSS. Finally, there was no significant group difference between baseline and post-treatment for the Participant self-reported ASR Anxiety Problems or Composite Coping Self-Efficacy Scale.

Leisure Program

One study assessed a leisure program developed to improve the involvement of young adults with ASD, without ID, in social activities.

Assessed Interventions: Palmen *et al.* [91] assessed a leisure program in a single study.

Sessions: The program spanned more than six months and consisted of 15 group sessions, starting with a frequency of once a week for the first four sessions that decreased to once every six weeks by the last two.

Target Population and Diagnostic Criteria: The target population was young adults with a diagnosis of ASD without ID established by a licensed psychiatrist according to DSM-IV criteria

Study Design: As group assignment was based on the order in which participants applied for participation, it was not a RCT.

Control Condition: This program was compared to TAU.

Primary Outcomes: Primary outcomes were Need for Leisure Support, Engagement in Leisure Activities, and Satisfaction in Leisure Lifestyle, three scales developed specifically for this study [91] that were not previously validated.

Main Results: Overall, there was a significant decrease in the need for leisure support, favoring the intervention group. However, there was a general trend towards a more regular leisure activity pattern in both groups over time. The mean percentage of leisure satisfaction for the program group increased and between-group statistics indicate a medium effect.

Discussion

We systematically reviewed the literature concerning the efficiency of existing psycho-educational interventions for young people with ASD without ID transitioning to adulthood. It should thus be representative of the current state of research regarding this field.

Overall, very little research concerning group interventions has been conducted in adults with ASD without ID, especially as they grow older. As a result, studies targeting adults/adolescents with ASD without ID transitioning to adulthood are the source of the largest samples to date of adult-age ASD individuals, which make our findings difficult to compare with those of other studies. However, although there are specific features pertaining to the period of the transition to adulthood, our findings are consistent with those obtained for younger individuals, showing that both SST [92] and CBT/ACT [93] interventions are efficient in improving ASD core symptoms and comorbidities.

Our eligibility criteria focused on group-based interventions, which we believe can be a true asset for this population, especially in light of the proof of their efficacy in younger individuals with ASD. Existing studies encompass a wide range of interventions, ranging from SST and psychoeducation to CBT and ACT-group based interventions. Overall, most of the reviewed studies reported a significant positive impact of group-based intervention on socialization, cognition, global functioning, and psychiatric comorbidities, such as anxiety or depression.

The strongest level of evidence was found for SST-, CBT-, and ACT-based interventions. The methodological quality of SST studies was rated as excellent for two [22,24], good for four [20,23,25,21], and fair for two [19,27]. The methodological quality of seven papers studying CBT and ACT-based interventions was rated as good [62,63,66,64,67,69,65], and poor for one [68]. However, although the SST protocol was well described in an appendix of one study [19] and online for four others [20,22,23,25], START [21], KONTAKT [27] and the program of Nadig *et al.* [24] were insufficiently described. The CBT and ACT protocols were also insufficiently described [62,63,67-69] or accessible only upon request [64,66,65].

The findings were more mixed for the three papers studying cognitive remediation, the methodological quality having been rated as excellent for one paper [51] but fair for the two others [50,52], with no description or available information of the intervention protocol.

The methodological quality of the study examining the “ACCESS” multimodal intervention [87] was rated as good and the protocol was well described in the paper. However, only one study was available concerning this intervention and the results should be replicated. A RCT is ongoing for STEPS [94], another multimodal program.

The lowest level of evidence was found for the leisure program [91], for which only one study has been published, with the methodological quality rated as fair.

Finally, although there is an increasing number of high-level-evidence studies published concerning psycho-educational interventions, their number is still limited, thus limiting any generalizations. In addition, most of the reviewed studies were conducted on small samples, in which participants were recruited from a single center. Moreover, they used a wide range of outcomes and measures, which limits their comparison. Also, each intervention was compared to TAU without describing what it consisted of.

Strengths and Limitations of our Study

Our study had several strengths. First, the studies included in the review should be commended for being of generally high quality. There were however, factors that may have limited the interpretability of the results. One issue is the fact that only studies published in English or French were included in the review and that unpublished data were not included. The strong heterogeneity of the primary endpoints should also be noted. The use of a specific search equation, although allowing us to include as many studies as possible, may have missed some papers, especially if the authors did not use the same keywords and MeSH terms that we used. It should also be noted that we chose to focus on group-based intervention, because this can help young adults with ASD to meet other patients and as a result, increase their social engagement. However, it could be argued that this setting could increase anxiety and thus encourage individual psycho-educational programs. One such program has been tested [95] and also shows promise. Individual programs can also be better tailored for an individual's needs.

Recommendations for Practice

We found the strongest evidence for SST-, CBT-, and ACT-based interventions. Indeed, the description of the SST program and available information were better than for the other interventions, which can facilitate its implementation in clinical settings. In addition, ASD occurs frequently and is a life-long condition [1], which have been widely acknowledged as key factors that affect the provision of care, with many young people with high-functioning autism experiencing delays of many months before accessing educational intervention. In this context and from a purely economic perspective, the group format may allow for more efficient use of staff time and may also reduce waiting times for educational programs. As for other chronic conditions, the group format may also bring therapeutic benefits to young people with ASD by giving them opportunities to meet peers living

with the same condition. As we have outlined above, research suggests that group-based psycho-educational intervention has a wide range of potential benefits beyond being a pragmatic delivery mode for existing program content and that it can serve as a powerful basis to support behavioral change. Thus, professionals should consider group-based psycho-educational intervention is an appropriate and relevant service for ASD.

Recommendations for Research: In Future Systematic Reviews

There is a growing number of studies assessing the efficacy of group-based psycho-educational interventions in young adults with ASD but the limitations of the existing studies necessitate further research to improve our knowledge concerning effective interventions that need to be implemented. In future studies, authors should use larger samples and a multicentric design. Moreover, further studies must take into account the varying outcomes and measures used in the existing studies. Finally, if researchers compare their intervention to TAU, we recommend that they specify what it refers to.

Conclusions

There is a growing body of evidence that group-based educational interventions are effective approaches to improve behaviors in young adults with ASD. However, we observed considerable heterogeneity across studies in this review, both in terms of effect sizes and intervention design, delivery, and comparison to controls. Thus, despite encouraging evidence that group interventions can effectively support psycho-educational programs, very little is actually known about how groups should be organized to optimize their effectiveness. Our findings suggest that additional research is needed to validate existing programs using larger and more representative samples and to implement innovative programs targeting ASD behaviors or comorbid conditions.

Conflict of interests: The authors declare that they have no conflict of interests

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Conclusions

Il existe un nombre croissant de preuves montrant que les interventions éducationnelles de groupe sont une approche efficace pour améliorer les comportements chez les jeunes adultes avec TSA. En revanche, nous avons observé une hétérogénéité considérable parmi les études dans cette revue, à la fois en termes de taille d'effet et de design interventionnel, de délivrance et de comparaison à un groupe contrôle. En conséquence, et malgré la présence de preuves encourageantes que les interventions de groupe peuvent en effet être le support de programmes psycho-éducatifs, peu de choses sont connues sur la façon dont les groupes devraient être organisés pour optimiser leur efficacité. Nos observations suggèrent que des études supplémentaires sont nécessaires afin de valider les programmes existants en utilisant des échantillons plus grands et représentatifs et afin d'implémenter ces programmes innovants ciblant les symptômes du TSA ou les pathologies comorbides.

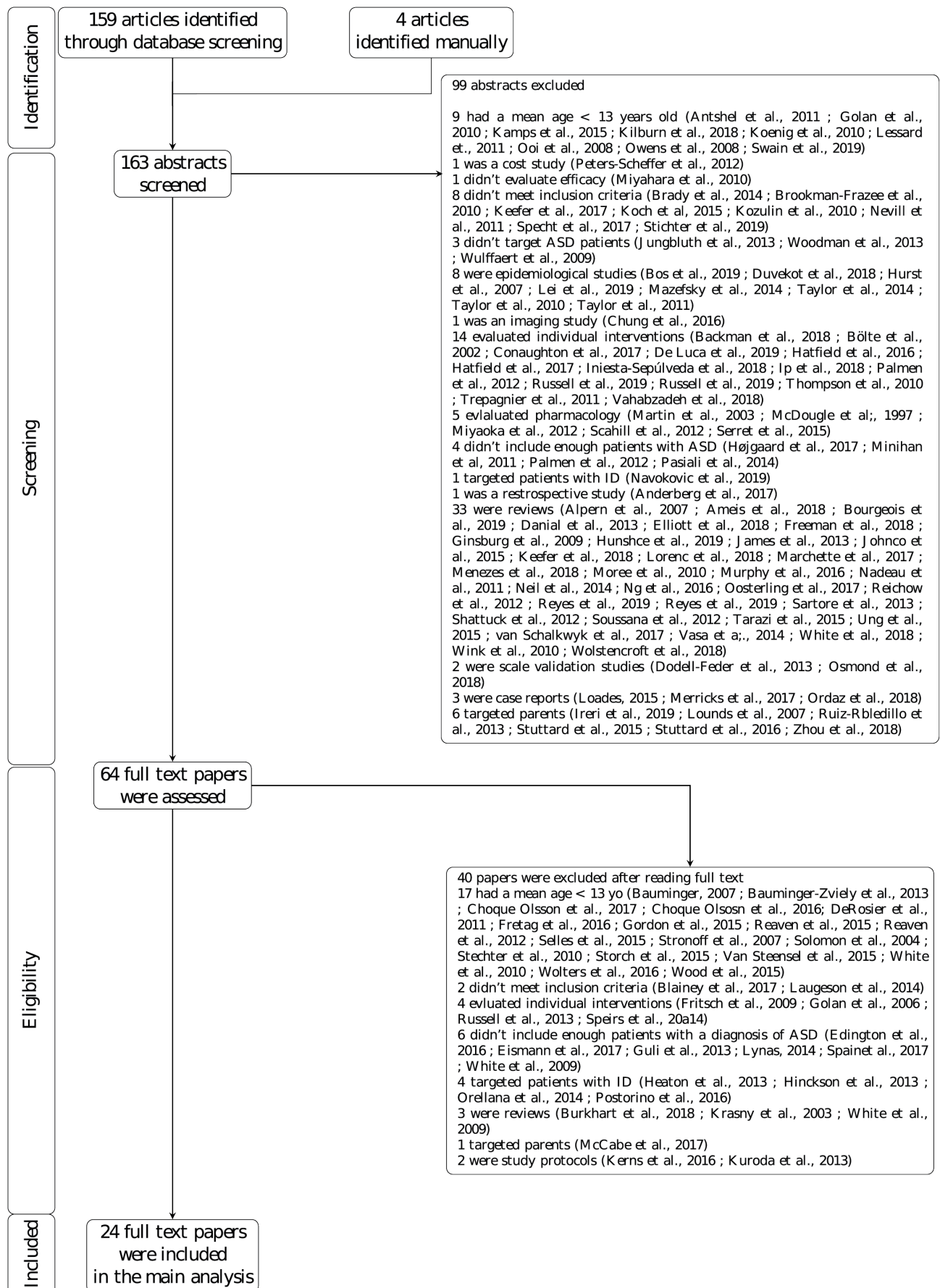


Figure 1 PRISMA Flow Chart

Table 1: Study Designs

Authors	Year of Publication	Target Population	Diagnosis Criteria Used	IQ	Age of Participants	Additional Inclusion Criteria	Group Comparability	Name of Intervention	Type of Intervention	Frequency	Number of Sessions	Training of Therapist	Control Condition	RCT	Size of Intervention Group	Size of Control Group	Outcomes	Measures Acceptability and Tolerance
Bonete et al.	2015	Adolescents and adults with Asperger's Syndrome, preferably with a job	ADI-R and ADOS	Normal	16-29 years old	None	Comparable	SCI Labour	Social skills training	Once a week	10	Trained for intervention	Healthy individuals	N	16 in Fall Semester 17 in Spring Semester 17 in Summer Semester	50	ESCI VABS-II O-APP	Y Compliance Attendance
Eack et al.	2013	Adults with ASD without ID	ADI-R or ADOS	Normal	18-45 years old	Social and cognitive disability	N/C	Cognitive enhancement therapy	Cognitive remediation	Variable	45	No information	No control group	N	14	0	CSQ-8 MATRICS Consensus Cognitive Battery Wisconsin Card Sorting Test MSCET Penn Emotion Recognition Test-40 Social Cognition Profile Cognitive Style and Social Cognition Eligibility Interview	Y Adherence Attendance Satisfaction
Eack et al.	2018	Adults with ASD without ID	ADI-R or ADOS	Normal	16-45 years old	Social and cognitive disability	Comparable Matched on demographic characteristics, as well as IQ and receipt of psychotropic medications	Cognitive enhancement therapy	Cognitive remediation	Variable	45	Master's and doctoral-level clinicians who were experts in its use in schizophrenia and had been trained in the treatment of ASD	EST (Enhanced Support Therapy)	Y	29	27	Major Role Adjustment Inventory MATRICS Consensus Cognitive Battery MSCET	Y Feasibility Acceptability
Gantman et al.	2012	Adults with ASD without ID	Previous diagnosis of AS, ASD or PDD-NOS, no confirmation needed	Normal	18-23 years old	Low adaptive functioning	Comparable	UCLA PEERS	Social skills training	Once a week	14	Trained in psychology	Wait-List and TAU	Y	9	8	SRS SSRS SELSA SSI QSQ TYASSK EQ DCL	N
Herbrecht et al.	2009	Children and Adolescent with ASD	ADOS and ADI-R	Normal	9.3-20.3 years old	None	N/C	KONTAKT	Social skills training	Children: once a week Adolescent : twice a week	7 ("experienced adolescent") 15 ("naïve adolescent") 29 ("naïve children")	Trained for ASD	No control group	N	7 ("experience d adolescent") 4 ("naïve adolescent") 6 ("naïve children")	0	GAS CGB PIA-CV-mini SKS FaBel FEG	N
Hesselmark et al.	2014	Adults with ASD without ID	ADOS	Normal	Aged 18 or older	None	Comparable	No specific name, Group CBT	CBT	Once a week	36	Trained in CBT	Recreational Group	Y	34	34	SoC Scale RSES QOLI CGI AQ BDI ASRS SCL-90	N
Ko et al.	2019	Adolescents with Autism Spectrum Disorder without ID	Diagnosis of ASD meeting current DSM-5 criteria	Normal	12-17 years old	None	Comparable	START	Social skills training	Once a week	20	Completed training for START	Wait-List and TAU	Y	20	20	Questions asked Positive facial expressions Mutual engagement	N
Laugeson et al.	2012	Adolescents with Autism Spectrum Disorder without ID	Previous diagnosis of ASD from a licensed mental health or medical professional	Normal	12-17 years old	None	Comparable	UCLA PEERS	Social skills training	Once a week	14	Trained for PEERS	Wait-List and TAU	Y	14	14	SSRS SRS QPQ TASSK-R QSQ	N
Laugeson et al.	2015	Young adults with ASD without ID	Previous diagnosis of ASD from a licensed mental health or medical professional	Normal	18-24 years old	Social problems as reported by the caregiver	Comparable	UCLA PEERS	Social skills training	Once a week	16	Trained in psychology	Wait-List and TAU	Y	12	10	SSRS TYASSK SRS EQ	N
Leung et al.	2019	Young adults with ASD without ID	Cconfirmed ASD-related diagnosis, including Autistic Disorder, Pervasive Developmental	Normal	18-29 years old	None	N/C	CBT-CSCA (Adult)	Social skills training using CBT	Once a week	15	Registered clinical psychologists, counsellors or social workers, all with a graduate or	No control group	N	57	0	MSCC-C AQ-10-Adult-HK DASS-21	Y Applicable

			Disorder-Not Otherwise Specified (PDD-NOS), Asperger's Syndrome or Social Communication Disorder.									post-graduate qualification						PSS-C	
Maddox et al.	2017	Adolescents with Autism Spectrum Disorder without ID	ADOS and ADI-R	Normal	12-17 years old	Anxiety disorder	Comparable	MASSI	CBT	Once a week	14	Trained for intervention	Wait-List and TAU	Y	15	15	ADIS-C/P SRS Loneliness Questionnaire DASS	N	
McGillivray et al.	2014	ASD adults with depression and/or anxiety	Former diagnosis of Asperger Syndrome/High Functioning Autism	Supposedly normal, but not confirmed	15-25 years old	Patient depression/anxiety	Comparable	"Think well, feel well and be well"	CBT	Once a week	9	No information	Wait-List and TAU	N	26	16	ATQ ASSQ ADIS C/P	N	
Murphy et al.	2017	Young people with ASD and anxiety	ADI-R	Normal	12-18 years old	Anxiety disorder	Comparable	MASSI	CBT	Once a week	14	Trained in CBT or counselling	Person centred counselling	Y	17	19	SRS CASI-Anx PCTPRS Therapy Process Observational Coding System—Alliance scale	Y Alliance	
Nadig et al.	2018	Young adults with ASD without ID	ADOS or SCQ	Normal	18-32 years old	None	Comparable	Transition Support Program	Social skills training	Once a week	10	No information	Wait-List and TAU	Y	20	10	SDS QoL-Q-Abridged Social Problem-Solving Task Coping Self Efficacy Scale	N	
Oswald et al.	2018	Young adults with ASD without ID	ADOS	Normal	18-38 years old	Experiencing difficulties with leisure	Comparable Stratified by age (< 25 vs. ≥ 25), sex (male vs. female), and IQ (≥ 85 vs. < 85)	ACCESS	Social skills training CBT Psychoeducation	Once a week	19	Trained in developmental psychology	Wait-List and TAU	Y	28	16	ABAS-3 ASR Seven Component Self-Determination Skills Survey	Y Acceptability	
Pahnke et al.	2014	Students with ASD without ID	Previously diagnosed with Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-IV) (high-functioning) ASD	Normal	13 years old or older	None	Comparable except for sex	Acceptance and commitment therapy-based skills training group for students	ACT	Twice a week	12	Trained in psychology and ACT	Wait-List and TAU	Y	15	13	SDQ SSS BYI	Y Feasibility	
Palmen et al.	2011	Young adults with ASD without ID	Diagnosis of ASD as established by a licensed psychiatrist according to DSM-IV criteria	At least low average	16-35 years old	None	No test	Leisure program	Leisure activities	From once to week to once in 6 weeks	15	No information	TAU	N	7, 4 in leisure engagement and 3 in leisure management	5	Need for Leisure Support Engagement in Leisure Activities Satisfaction in Leisure Lifestyle	Y Acceptability	
Rabin et al.	2018	Adolescents with Autism Spectrum Disorder without ID	ADOS	Normal	12-17 years old	No behaviour problems	Comparable	PEERS	Social skills training	Once a week	16	No information	Wait-List and TAU	Y	20	21	CASS TASSK QSQ LSDQ EQ SRS SSIS BDI	N	
Santomauro et al.	2016	Adolescents with Autism Spectrum Disorder without ID	diagnosis of an ASD from a Medical Practitioner, Paediatrician, Psychiatrist, Psychologist, or multi-disciplinary team	Normal	Mean age : 15.75 years old	Depression	Comparable	Exploring Depression: Cognitive behaviour therapy to understand and cope with depression	CBT	Once a week for the first 10 sessions 11th session 4 week after the 10th session	11	Registered clinical psychologists	Wait-List and TAU	Y	11	12	DASS ERQ: reappraisal ERQ: suppression SCSQ	Y Satisfaction	
Turner Brown et al.	2008	Adults with ASD without ID	ADOS	Normal	18-55 years old	None	Comparable on IQ and sex Significant difference on age, race	SCIT-A	Cognitive remediation	Once a week	18	No information	TAU	N	6	5	Hinting Task FEIT SSPA SRS	Y Satisfaction	
White et al.	2013	Adolescents with Autism Spectrum Disorder	ADOS and ADI-R	Normal	12-17 years old	Anxiety disorder	Comparable	MASSI	CBT	Once a week	14	Trained for intervention	Wait-List and TAU	Y	15	15	DD-CGAS CASI-Anx CGI-I PARS	Y Involvement Satisfaction	

ESCI = Evaluación de Solución de Conflictos Interpersonales, VABS-II = Vineland Adaptive Behavior Scales, Second Edition, MATRICS Consensus Cognitive Battery = Measurement and Treatment Research to Improve Cognition in Schizophrenia Consensus Cognitive Battery, O-APF = Onabotulinum A Toxin Profile, MSCEIT = Mayer-Salovey-Caruso Emotional Intelligence Test, SSRS = Social Skills Rating System, SELSA = Social and Emotional Loneliness Scale for Adults, SSI = Social Skills Inventory, TYASSK = Test of Young Adult Social Skills Knowledge, SRS = Social Responsiveness Scale, EQ = Empathy Quotient, Soc Scale = Sense of Coherence Scale, CGI-I = Clinical Global Impression (1 = Improvement), RSES = Rosenberg's Self-Esteem Scale, BDI = Beck Depression Inventory, QOLI = Quality of Life Inventory, AQ = Autism Spectrum Quotient, ASRS = Adult ADHD Self-Report Scale, SCL-90 = Symptom Checklist-90, QSQ = Quality of Socialization Questionnaire, DASS = Depression Anxiety Stress Scales, ATQ = Automatic Thoughts Questionnaire, ADIS C/P = Anxiety Disorders Interview Schedule: Child and Parent Version, ASD = Autism Spectrum Disorder, PCTPRS = Primary Care Therapy Process Rating Scale, ABAS-3 = Adaptive Behavior Assessment System - Third Edition, ASR = Adult Self Report, SDQ = Strengths and Difficulties Questionnaire, BYI = Beck Youth Inventories, SCSQ = Social Communication Skills Questionnaire, FEIT = Face Emotion Identification Test, DD-CGAS = Developmental Disabilities modification of Children's Global Assessment Scale, CASI-Anx = Childhood Anxiety Sensitivity Index - Anxiety, PARS = Pediatric Anxiety Rating Scale, CSSES = Coping Self-Efficacy Scale, SSPA = Social Skills Performance Assessment, PQO = Quality of Play Questionnaire, TASSK-R = Test of Adolescent Social Skills Knowledge-Revised, CBT-CSCA = CBT-Context-Based Social Competence Training for ASD, MSCS-C = Multidimensional Social Competence Scale - Chinese Version, AQ - 10 - Adult - HK = Hong Kong Chinese Version of Autism Spectrum Quotient 10 Items, DASS-21 = Depression Anxiety and Stress Scales - 21, PSS - C = Parental Stress Scale - Chinese Version, SCQ = Social Communication Questionnaire, SDS = Self-Determination Scale, QoL-Q-Abridged = Quality of Life Questionnaire, Abridged Version, TASSK = Test of adolescent Social Skills knowledge, CASS = Contextual Assessment of Social Skills, LSDQ = Loneliness and Social Dissatisfaction Questionnaire, SSIS = Social Skills Improvement System, ASDI = Asperger Syndrome Diagnostic Interview, ERQ = Emotion Regulation Questionnaire

Primary Outcomes as marked in green

Table 2: Quality Assessment using PEDro Scale

Authors	Publication Year	eligibility criteria were specified	subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)	allocation was concealed	the groups were similar at baseline regarding the most important prognostic indicators	there was blinding of all subjects	there was blinding of all therapists who administered the therapy	there was blinding of all assessors who measured at least one key outcome	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	the results of between-group statistical comparisons are reported for at least one key outcome	the study provides both point measures and measures of variability for at least one key outcome	Overall Quality
Cognitive Remediation													
Eack et al.	2013	Y	N	N	N	N	N	N	Y	Y	N	Y	4
Eack et al.	2018	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	9
Turner Brown et al	2008	Y	N	N	Y	N	N	N	Y	N	Y	Y	5
Social Skills Training													
Bonete et al.	2015	Y	N	N	N	N	N	N	Y	N	Y	Y	4
Gantman et al.	2012	Y	Y	Y	Y	N	N	N	Y	Y	Y	N	7
Herbrecht et al.	2009	Y	N	N	N	N	N	Y	N	Y	Y	Y	5
Ko et al.	2019	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	6
Laugeson et al.	2012	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	9
Laugeson et al.	2015	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Nadig et al.	2018	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	9
Rabin et al.	2018	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	7
CBT/ACT													
Hesselmark et al	2014	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Leung et al.	2019	Y	N	N	N	N	N	N	Y	N	N	Y	3
Maddox et al.	2017	Y	Y	Y	Y	N	N	N	N	N	Y	Y	6
McGillivray et al.	2014	N	N	Y	Y	N	N	N	Y	Y	Y	Y	6
Murphy et al.	2017	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	8
Pahnke et al.	2014	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Santomauro et al.	2016	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	7

White et al.	2013	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	8
Multimodal Intervention													
Oswald et al.	2018	Y	Y	Y	Y	N	N	N	Y	N	Y	Y	7
Leisure Program													
Palmen et al.	2011	Y	N	N	N	N	N	N	Y	Y	Y	Y	5

This table shows quality assessment per article using PEDro scale

For columns C-M: Y = Yes, N = No

For column N: Overall Quality: Dark blue = Excellent, Light blue = Good, Yellow = Fair, Orange = Poor (Number corresponds to the number of Y for the study in question)

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Supplementary Data 1: Scales used as Primary and Secondary Outcomes

- The **Adaptive Behavior Assessment System—Adult Form, Third Edition** [96] is an informant report providing comprehensive assessment of adaptive functioning in individuals with developmental delays, including ASD. The ABAS-3 includes the norm-referenced General Adaptive Composite (GAC), and three Composite scales : Social, Conceptual & Practical.
- The **Adult ADHD Self-Report Scale** [97] measures inattention, hyperactivity and impulsivity in adults.
- The **Anxiety Disorders Interview Schedule for Children/Parents** [76] is an interview that assesses the following dimensions : (1) School History, (2) School Refusal Behavior, (3) Separation Anxiety Disorder, (4) Interpersonal Relationships, (5) Social Phobia (Social Anxiety Disorder), (6) Specific Phobia, (7) Panic Disorder, (8) Agoraphobia (With or Without Panic Disorder), (9) Generalized Anxiety Disorder, (10) Obsessive-Compulsive Disorder, (11) Posttraumatic Stress Disorder (PTSD)/ Acute Stress Disorder, (12) Affective Disorders: Dysthymia, (13) Affective Disorders: Major Depressive Disorder, (14) Externalizing Disorders, (15) Conduct Disorder, (16) Oppositional Defiant Disorder, (17) Selective Mutism, (18) Enuresia, (19) Sleep Terror Disorder (20) Screening Questions for Additional Childhood Disorders, (21) Family History and Genogram and (22) Treatment History.
- The **Anxious Self-Statements Questionnaire** [75] is a measure of the frequency of cognitive self-statements associated with anxiety.
- The **ARC's Self-Determination Scale** [40] is a measure of self-determination and is a 72-item self-report measure with four subscales: Autonomy, Self-regulation, Psychological Empowerment and Self-Realization.
- The **ASEBA Adult Self-Report** [90] is a standardized self-report completed by the participant that contains the DSM-oriented scale Anxiety Problems.
- The **Autism Quotient** [98] is a 50-item screening instrument for measuring autistic traits.
- The **Automatic Thoughts Questionnaire** [74] is a measure of frequency of cognitive self-statements associated with depressed mood and includes 30 negative self-statements theoretically associated with depression.
- The **Beck Depression Inventory** [85] is a 21-question multiple-choice self-report inventory used to assess depression severity.
- The **Beck Youth Inventories** [83] are a self-rating questionnaire that consists of five subscales : anxiety, depression, anger, disruptive behaviour and self-concept.
- The **Checklist for Group Behaviours** [44] (CGB) is a rating scale comprising 19 six-point scaled items (0–5) detecting social skills in group context
- The **Child and Adolescent Symptom Inventory-4 ASD Anxiety Scale** [77] is a measure of anxiety specifically developed for people with ASD.
- The **Client Satisfaction Questionnaire-8** [53] is a measure of treatment satisfaction that has been widely employed to assess the acceptability of psycho- therapy programs.
- The **Clinical Global Impression Scales** [99] are a set of two scales:

- The **severity scale** (CGI-S) is a 7-point scale that requires the clinician to rate the severity of the patient's illness at the time of assessment, according to his/her experience regarding the current diagnosis
- The **improvement scale** (CGI-I) is a 7-point scale that requires the clinician to assess how much the patient's illness has improved or worsened relative to a baseline state at the beginning of the intervention.
- The **Cognitive Style and Social Cognition Eligibility Interview** [100] is designed to elicit responses and behaviors from participants about cognitive and functional challenges in their lives that reflect the core cognitive profiles or “styles” that become key treatment targets in CET.
- The **Contextual Assessment of Social Skills** [34] is a live role-play assessment of conversational skills, developed for adolescents with high-functioning ASD.
- The **Coping Self-Efficacy Scale** [89] is a 26-item self-report measure of one’s own perceived ability to cope effectively with life challenges.
- The **Depression Anxiety Stress Scales** [73] is a 42-item rating scale in which respondents are asked to rate on a 4-point scale, ranging from “did not apply to me at all” to “applied to me very much, or most of the time” a range of possible events that may have occurred during the past week. It consists of 3 sub scales: depression, anxiety and stress.
- The **Developmental Disabled Children's Global Assessment Scale** [79] is a measure of global functioning in children with developmental disabilities.
- The **Diagnostic CheckList for pervasive developmental disorders** [42] (DCL) is an ICD-10/DSM-IV based scale, which covers abnormalities in the areas of social interaction (DCL-S), communication (DCL-K) and stereotyped, repetitive behaviours and interests (DCL-ST).
- The **Emotion Regulation Questionnaire** [86] is a 10-item measure designed to assess participants’ use of two prominent emotion regulation strategies: cognitive reappraisal and expressive suppression.
- The **Empathy Quotient** [31] is a caregiver-report measure of empathy.
- The **“Evaluación de Solución de Conflictos Interpersonales”** (Evaluation of Interpersonal Conflicts Solutions) scale [37] is aimed at interpersonal problem solving skills. It consists of 12 sequences of images representing an interpersonal conflict, shown on the computer. Participants are required to give written answers to the following questions: (1) How does the principal character in the drawing feel? (2) Why does he/she feel this way? (3) What could he/she do to improve this situation? The task provides a total score and a score for each dimension: Emotion (ESCI-E), Situational Concordance (ESCI-C) and Solutions (ESCI-S).
- The **FaBel** is a German adaptation of the internationally well-established **Impact-on-Family-Scale** [47]. It is a 33-item questionnaire to assess the family burden caused by a mentally ill offspring. Items are scored on a 4-point scale. The items assess the general negative impact of parents, the description of social relationships, the concern for siblings, the financial impact and problems in coping as well as a total score
- The **Face Emotion Identification Test** [59] is a 19-item test comprised of photographs of faces expressing six basic emotions (i.e., happy, sad, angry, afraid, surprised, and ashamed). Participants indicates which emotion is expressed in each photograph.

- The **Global Assessment of functioning Scale** [43] is a rating scale to measure the level of every day's psychosocial functioning scoring from 0 to 100
- The **Hinting Task** [60] is a measure of ToM skills. This task consists of 10 brief, written vignettes that describe social interactions between two characters that end with one uttering a hint. Participants indicate what the character really means by the hint.
- The **Hong Kong Chinese Version of Autism-Spectrum Quotient-10 Items** (AQ-10-Adult-HK) is shortened Chinese version of the AQ.
- The **Loneliness and Social Dissatisfaction Questionnaire** [35] is a 16-item, standardized self-report measure that assesses global feelings of loneliness and social inadequacy on a scale of 1 (not true at all) to 5 (always true). Higher scores represent greater loneliness.
- The **Loneliness Questionnaire** [80] is a 30-item self-report measure used to assess loneliness in youth with ASD. The questionnaire distinguishes between emotional loneliness and social loneliness.
- The **Major Role Adjustment Inventory** [58] is an interview-based assessment of role functioning
- The **Mayer-Salovey-Caruso Emotional Intelligence Test** [57] is a test that assesses measures of emotion processing and regulation abilities that in the domains of emotion perception, facilitation (using emotions to facilitate thought).
- The **Measurement and Treatment Research to Improve Cognition in Schizophrenia Consensus Cognitive Battery** [55,54] aims at assessing cognitive deficits. This battery has been validated initially for patients with schizophrenia.
- The **Multidimensional Social Competence Scale-Chinese Version** [84] aims to assess social competence of high-functioning individuals with ASD in a multidimensional perspective. The questionnaire contains 77 items and a higher score indicating greater social competence. It contains seven domain scores on Social Motivation (SM), Social Inferencing (SI), Demonstrating Empathic Concern (DEC), Social Knowledge (SK), Verbal Conversation Skills (VCS), Nonverbal Sending Skills (NSS) and Emotional Regulation (ER).
- **Mutual engagement** [21] was defined as the percentage of intervals in which both individuals contributed equally in a back-and-forth manner
- The **Osnabruck Work Capabilities Profile** [39] consists of 30 items using a Likert-type scale. Assessment is carried out by the participant's supervisor and self-reports. The scale ranges from 1 (total lack of skill) to 4 (always present). Assessment of rehabilitants is performed on three subscales, each with 10 items: learning ability (LA), social communication and interactional competence (SIC) and social adaptation and motivation (SAM).
- The **Parental Stress Scale-Chinese Version** [101] (PSS-C) is an 18-item questionnaire for assessing parental stress and parental role' satisfaction.
- The **Pediatric Anxiety Rating Scale** [78] is a dimensional rating designed to assess symptoms across SAD, SoP, and GAD. The first section includes 50 specific anxiety symptoms rated as present or absent over the previous week. In the second section, the clinician rates symptom severity for the past week on a six- point scale (0 = none, 5 = extreme) across seven different dimensions (number of endorsed symptoms, frequency, severity of distress, severity of physical symptoms, avoidance, interference at home, and interference out of home).

- The **Penn Emotion Recognition Test-40** [102] assesses facial emotion recognition ability and includes 40 color photographs of faces expressing 4 basic emotions.
- **Positive facial expressions** [21] was calculated to determine the percentage of time the participant was displaying positive facial expressions.
- The **Primary Care Therapy Process Rating Scale** [103] comprises three subscales; one assessing the extent to which the therapist uses CBT techniques, one assessing the use of counselling and one to provide a measure of therapeutic alliance.
- The **Quality of Life Inventory** [70] is a 32-item measurement of life satisfaction assessing areas, such as health, relationships, employment and living conditions.
- The **Quality of Life Questionnaire, Abridged Version** [24] evaluates quality of life and is an abridged version of the Quality of Life Questionnaire [104]. The original 40-item questionnaire assesses the domains of satisfaction, competence/productivity, empowerment/independence, and social belonging/community integration in people with disabilities. The parts regarding employment were stripped in the abridged version.
- The **Quality of Play Questionnaire** [33] consists of 12-items administered to parents and adolescents to assess the frequency of hosted and invited get-togethers over the previous month and to assess the level of conflict during the last hosted get-together.
- The **Quality of Socialization Questionnaire** [20] is a 12-item self- and caregiver-report measure adapted from the Quality of Play Questionnaire for children with ASD (Frankel et al., 2010). It assesses the young adults' frequency of hosted and invited get-togethers over the previous month.
- The questionnaire **Engagement in Leisure Activities** [91] consists of eight items assessing participation and variation in leisure activities.
- The **Questionnaire for the Assessment of Group Behaviour** (FEG) [48] is a 23-item questionnaire measuring social behaviour in school setting.
- **Questions asked** [21] was defined as the percentage of questions asked by the participant during conversation
- The questionnaire **Need for Leisure Support** [91] consists of eight items assessing participants' need for assistance in managing leisure.
- The questionnaire **Satisfaction with Leisure Lifestyle** [91] consisted of 15 items measuring the degree of participants' satisfaction with his/her leisure lifestyle.
- The **Rosenberg Self-Esteem Scale** [72] is a 10-item instrument that measures self-esteem.
- The **Sense of Coherence Scale** [71] is a 29-item scale that measures perceived comprehensibility, manageability and meaning-fulness in life.
- The **Seven Component Self-Determination Skills Survey** [88] is an informant report that has been used to measure self-determination skills and capacities of young adults with ASD and measures two domains; Performance and Importance.
- The **shortened version of the Parent's Interview for Autism** (PIA-CV-mini) [45] is a measure of the severity of ASD which comprises 31 five-point scaled items (0–4), which are assigned to six behavioural domains: social area (eight items, PIA-S), affective reactivity (five

items, PIA-AR), interaction with peers (four items, PIA-INT), communication (six items, PIA-K), stereotyped behaviour (five items, PIA- ST) and need for sameness (three items, PIA-GL)

- The **Social and Emotional Loneliness Scale for Adults** [30] is a 37-item self-report measure of romantic, social, and family loneliness.
- The **Social Cognition Profile** [100] is a 50-item clinician-rated measure of social-cognitive behaviours which assesses the domains of tolerant, perceptive, and self- confident behaviours indicative of adequate social cognition.
- The **Social Communication Skills Questionnaire** [61] is a self-report measure of social-communication skills. It is a 26-item measure developed for use with individuals with traumatic brain injury that focuses on communication as a central feature of social competence.
- The **Social Competence Scale** (SKS) [46] is a parent questionnaire comprising 25 five-point scaled items measuring general social skills.
- The **Social Problem-Solving Task** [41] is a measure of social skills, initially developed for patients with brain injury. It was adapted by [24] for use with ASD patients. It involves 10 two-three sentence scenarios that present a social problem or situation that could occur in daily life.
- The **Social Responsiveness Scale** [28] is a measure of social impairments of ASD, initially developed for children and adolescents 4-18 years old.
- The **Social Skills Improvement System** [36] is a standardized rating scale that assesses global social competence for children aged 3–18 years.
- The **Social Skills Inventory** [105] is a 90-item self-report measure of social skills for adults.
- The **Social Skills Performance Assessment** [106] is a role-play assessment in which the subject participates in three conversations for 3 min each on predetermined topic. For each role-play, ratings of interest, fluency, clarity, focus, affect, social appropriateness, and conversation, are provided. Across the three role-plays, a total of 16 skills are rated.
- The **Social Skills Rating System** [29] is a 52-item, caregiver-report questionnaire using standard scores. It assesses the frequency of the display of a variety of social skills at home, in the classroom, and in interactions with peers. SSRS subscales include cooperation, assertion, responsibility, and self-control.
- The **Strengths and Difficulties Questionnaire** [82] is a brief behavioural screening instrument developed for 3- to 16-year-old children, consisting of 25 items. The scale has five subscales representing emotional symptoms, behaviour problems, hyperactivity/ inattention, peer relationship problems and prosocial behaviour.
- The **Stress Survey Schedule for Autism and Other Developmental Disorders** [81] is a scale used to assess behaviours related to stress and the items are categorized into eight subscales representing categories of situations that children with ASD and other developmental disabilities normally perceive as stressful: changes, anticipation, social interaction, pleasant events, sensory stimuli, unpleasant events, food situations and rituals.
- The **Symptom Checklist 90** [107] is a 90-item questionnaire assessing the presence and severity of various psychiatric symptoms. The primary symptom dimensions assessed are (1) somatization, (2) obsessive-compulsive, (3) interpersonal sensitivity, (4) depression, (5) anxiety, (6) hostility, (7) phobic anxiety, (8) paranoid ideation, (9) psychoticism, and (10) a category of "additional items".

- The **Test of Adolescent Social Skills Knowledge-Revised** [26] is a 26-item criterion-referenced measure developed to assess treatment changes related to the adolescent's knowledge about the specific social skills taught during UCLA PEERS. The TASSK-R is based upon the original **Test of Adolescent Social Skills Knowledge** [32]. Specific changes are not outlined between the 2 versions.
- The **Test of Young Adult Social Skills Knowledge** is a 23-item criterion-referenced measure based on the Test of Adolescent Social Skills Knowledge [32] and modified for young adults.
- The **Therapy Process Observational Coding System—Alliance Scale** [108] is a nine-item measure consisting of a child and parent form designed which result in a comprehensive coding system capable of objectively describing child–therapist and parent–therapist alliance.
- The **Vineland Adaptive Behavior Scales, Second Edition** [38] is designed to measure adaptive behaviour in subjects up to 90 years old, on the basis of a report with a Likert-type scale completed by parents or informers. It consists of 3 subscales: Communication (Receptive, Expressive, and Written); Daily Living Skills (Personal, Domestic, Community) and Socialization (Interpersonal Relationships, Play and Leisure Time, Coping Skills).
- The **Wisconsin Card Sorting Test** [56] is a measure of cognitive flexibility.

Legend

Scales in **dark red** evaluate Social Skills/Self Determination Skills

Scales in **dark green** evaluate Adaptive and Global Functioning

Scales in **orange** evaluate Work Capabilities

Scales in **teal** evaluate Neuro or Social Cognition

Scales in **dark blue** evaluate Knowledge about ASD

Scales in **purple** evaluate Severity of ASD

Scales in **pink** evaluate Self-esteem

Scales in **light green** evaluate Depression/Anxiety

Scales in **light red** evaluate Quality of Life

Scales in **light blue** evaluate Therapeutic Adherence and Alliance

Scales in **maroon** evaluate Leisure capabilities

Scales in **coral** evaluate Inattention, hyperactivity and impulsivity

Scales in **grey** are Broad Psychiatric Measures

SERMENT

En présence des Maîtres de cette école, de mes chers condisciples et devant l'effigie d'Hippocrate, je promets et je jure, au nom de l'Être suprême, d'être fidèle aux lois de l'honneur et de la probité dans l'exercice de la médecine.

Je donnerai mes soins gratuits à l'indigent et n'exigerai jamais un salaire au-dessus de mon travail.

Admis (e) dans l'intérieur des maisons, mes yeux ne verront pas ce qui s'y passe, ma langue taira les secrets qui me seront confiés, et mon état ne servira pas à corrompre les mœurs, ni à favoriser le crime.

Respectueux (se) et reconnaissant (e) envers mes Maîtres, je rendrai à leurs enfants l'instruction que j'ai reçue de leurs pères.

Que les hommes m'accordent leur estime si je suis fidèle à mes promesses. Que je sois couvert (e) d'opprobre et méprisé (e) de mes confrères si j'y manque.

Abstract/Résumé

Background: There is a growing number of young people transitioning to adulthood diagnosed with an autism-spectrum disorder (ASD). Among them, individuals without an intellectual deficiency have significant adaptive deficits and need individualized care and support services targeting better vocational, social, and educational outcomes. Group-based interventions, including patient education, social-skills training, and cognitive-behavioral therapy, are widely used in clinical settings to improve the daily life and outcomes of individuals who have ASD and face the challenge of transitioning to adulthood.

Methods: We performed a systematic review of studies concerning the efficiency of group-based educational interventions focusing on the transition to adulthood among young people with ASD with normal intellectual functioning.

Results: Following a systematic search, 21 studies among 163 were found to be eligible for inclusion. Stronger evidence was found for social-skills training and cognitive-behavioral therapy interventions.

Conclusion: Professionals should consider group-based psycho-educational intervention to be an appropriate and relevant service for young adults with ASD. Further research is needed on larger samples using a multicentric design to validate their efficiency before generalization.

Contexte : Il existe un nombre croissant de jeunes personnes entrant dans la transition vers l'âge adulte et ayant un diagnostic de trouble du spectre de l'autisme. Parmi eux, les individus sans déficience intellectuelle présentent des déficits des capacités adaptatives et ont besoin de prises en charge individualisées et de services de soutiens ciblant de meilleures améliorations sur le plan social, éducationnel et professionnel. Les interventions de groupe incluant l'éducation au patient, les entraînements aux habiletés sociales et la TCC sont fréquemment utilisés en pratique courante afin d'améliorer la vie quotidienne et les résultats des sujets avec TSA et qui sont face au challenge de la transition vers l'âge adulte.

Méthodes : Nous avons fait une revue systématique des études sur l'efficacité des interventions éducationnelles de groupe ciblant la transition vers l'âge adulte parmi les jeunes personnes avec TSA et une fonctionnement intellectuel normal.

Résultats : Après une recherche systématique, 21 études parmi 163 ont été considérées éligibles pour l'inclusion. De meilleures preuves ont été mise en évidence parmi celles se focalisant sur la TCC ou l'entraînement aux habiletés sociales.

Conclusion : Les professionnels doivent prendre en considération le fait que les interventions éducationnelles de groupe sont adaptées et pertinentes pour les jeunes adultes avec TSA. Des études supplémentaires sont nécessaires sur de plus grands échantillons et avec un design multicentrique afin de valider l'efficacité de ces interventions avant une potentielle généralisation

Mots-Clés

Troubles du spectre de l'Autisme, Psychiatrie du développement, Psychiatrie, Psychiatrie de l'Enfant et de l'Adolescent, Neurodéveloppement, Interventions de Groupe, Psychoéducation, TCC