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VARIABLES INVOLVED IN THE FUNCTIONING OF ADULTS WITH AUTISM SPECTRUM DISORDER LEVEL 1: A NARRATIVE REVIEW

Variables implicadas en el funcionamiento de los adultos con trastorno del espectro autista nivel 1: revisión narrativa

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Abstract: *Introduction and objectives*. Several studies indicate that adolescents and adults with ASD level 1 (ASD-1) have difficulties in their functioning despite not having a comorbid intellectual disability. For this reason, the objective of this review was to analyse factors that significantly influence adults with ASD-1 functioning. The search terms Asperger's, "high-functioning autism", adapt*, "daily function*" and synonyms were used in 14 databases. A total of 44 articles were finally included in this review. *Results and conclusions*. Multiple factors are involved in the functioning of adults with

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ASD-1, such as the implementation of transition to adulthood programs, executive functions impairment, level of affectation in symptomatology and mental health, along with socio-environmental factors. The few studies that have been carried out on this last factor mention that families and professionals play an important role in the functioning of adults with ASD-1. Therefore, on its own, IQ is not a consistent predictor of functioning. As an important conclusion, studies that measure functioning holistically are required.

KEYWORDS: High functioning autism; Asperger's; social functioning; adaptive behaviour.

RESUMEN: *Introducción y objetivos*. Diversos estudios indican que los adolescentes y adultos con TEA nivel 1 (TEA-1) tienen dificultades en su funcionamiento a pesar de no tener una discapacidad intelectual comórbida. El objetivo de esta revisión fue analizar los factores que influyen significativamente en el funcionamiento de adultos con TEA-1. Se utilizaron los términos de búsqueda Asperger's, "high-functioning autism", adapt*, "daily function*" y sinónimos en 14 bases de datos. Finalmente se incluyeron en esta revisión un total de 44 artículos. *Resultados y conclusiones*. Múltiples factores están involucrados en el funcionamiento de los adultos con TEA-1, como la implementación de programas de transición a la vida adulta, el deterioro de las funciones ejecutivas, el nivel de afectación en la sintomatología y la salud mental, junto con factores socioambientales. Los pocos estudios que se han realizado sobre este último factor mencionan que las familias y los profesionales juegan un papel importante en el funcionamiento de los adultos con TEA-1. Por lo tanto, por sí solo, el cociente intelectual no es un predictor consistente del funcionamiento. Como conclusión importante, se requieren estudios que midan el funcionamiento de manera integral.

PALABRAS CLAVE: Autismo de alto funcionamiento; Asperger; funcionamiento social; conducta adaptativa.

1. Introduction

The World Health Organization (WHO) defines functioning as the complex relationship and dynamic interaction between a person's health condition and contextual factors, both personal (intrinsic) and environmental (extrinsic). To analyse functioning, the constructs that make it up must be evaluated independently and then explore the links and causal relationships between them (WHO, 2001).

One of the methods for studying the functioning of people with disabilities is to measure *social functioning*. It is made up of social achievements that are expected in adulthood, such as: obtaining and maintaining a job, having a higher education, having adequate living conditions, participating in the community, and having satisfactory social relationships (Lord *et al.*, 2020; Rydzewska, 2012); all linked to the achievement of an independent life (Hume *et al.*, 2014; Mason *et al.*, 2020). In 1967,

Rutter *et al.* (as cited in Henninger and Lounds Taylor, 2012) proposed criteria for measuring social functioning; using the labels "good functioning" to refer to a neurotypical social life and satisfactory functioning at school and work; "fair functioning" to refer to social and educational progress despite difficulties in behaviour or social relationships; "poor functioning", in cases of difficulty in independent living but with the potential for social progress; and "very poor functioning", when there are significant difficulties in independent living.

In 2004, these criteria were reformulated and hierarchically organized by Howlin *et al.* (as cited in Henninger and Lounds Taylor, 2012), measuring functioning using three domains: "Social Relationships", "Employment", and "Independent Living". According to the sum of the scores obtained in all domains, performance is categorized as "very good" (high level of independence with some friends and a job), "good" (with a job but need some help in daily living activities, some friends or acquaintances), "fair" (kind of independence, need help or supervision, no friends, but some acquaintances), "poor" (need specialized residential support or need support in all domains, no friends) or "very poor" (high level hospital care, no friends, no autonomy).

Another way to study functioning is by assessing *adaptive behaviour*. This is defined as each person's ability to complete tasks of daily living (Levy and Perry, 2011) and the extent to which they can be self-sufficient in different real-life situations (Williams *et al.*, 2014). There are several psychometric instruments to measure adaptive behaviour, but two of them have been the most used in research: the Vineland scales, composed of the domains "socialization", "communication" and "skills for daily living" (Sparrow *et al.*, 2016), and the Adaptive Behaviour Assessment System (ABAS) composed of the domains "practical", "socialization" and "conceptual" (Harrison and Oakland, 2021). Also, the WHO (Ustun and Rehm, 2010), based on the biopsychosocial model of disability, created the Health and Disability Measurement Questionnaire (WHODAS). It is comprised of the domains "Comprehension and Communication", "Mobility", "Personal Care", "Relationship with Other People", "Activities of Daily Living" and "Social Participation".

It is also important to take into account that transition to adulthood is a process that is highly related to functioning, especially with social functioning, since it is "traditionally marked by the gradual emergence of objective demographic indicators" (Rydzewska, 2012, p. 87) such as post-obligatory education, adult relationships, employment, and independent living, which entail different levels of challenges and require different types of skills, like adaptative behaviour.

Both *social functioning* and *adaptive behaviour,* as well as their relationship with the process of transition to adulthood, have been studied in the population with Autism Spectrum Disorder (ASD), whose symptomatology is currently classified according to the level of severity and its corresponding level of external support required (American Psychiatric Association [APA], 2013). This research considered studies in which those who, according to the DSM-5, present a level 1 severity of autistic symptomatology (Table 1).

Table 1. Autism Spectrum Disorder Severity Level 1 according to the DSM-5 (APA, 2013, p. 32)

ASD Level 1: Needs Support	
Social Communication	**Restricted and repetitive behaviours**
Difficulties initiating social interactions as they offer atypical or unsatisfactory responses to other people's social openness. They may seem to have little interest in social interactions, as they sometimes fail to go back and forth in conversations and their attempts to make friends are eccentric and usually unsuccessful.	Behavioural inflexibility causes significant interference with functioning in one or more contexts. They have difficulty alternating activities. Organizational and planning problems hinder independence.

ASD level 1 may include the diagnostic labels Asperger's Syndrome (AS), Pervasive Developmental Disorder Not Otherwise Specified or Atypical Autism (APA, 2013) and the clinical descriptor High Functioning Autism (AAF) (Cererols, 2012). The diagnostic criteria part of these concepts was characterized by a mild level of severity in the symptomatology, which is why they may be currently considered as ASD level 1 (ASD-1).

Due, in part, to the fact that there is usually no comorbidity with intellectual disability (ID) and language disorder in people diagnosed with ASD-1, these individuals could mistakenly be considered to function well (Alvares *et al.*, 2020). However, research indicates that a high percentage of adults with ASD-1 have fair or poor *social functioning*, (i.e., greater disadvantages in economy, education, occupation, and social aspects) compared to their neurotypical peers (Arnold *et al.*, 2019; Brugha *et al.*, 2011; Howlin and Magiati, 2017; Mason *et al.*, 2020; Otsuka *et al.*, 2017) and peers with other types of disabilities (Hurley-Hanson *et al.*, 2020; Schall *et al.*, 2014), regardless of whether they were diagnosed early or late (Barahona-Correa, 2017).

In addition, the levels of *adaptive behaviour* of this population are usually below their cognitive functioning (Hudepohl *et al.*, 2015; Kenworthy *et al.*, 2010; Kraper *et al.*, 2017; Matthews *et al.*, 2015; Matthews *et al.*, 2017; Otsuka *et al.*, 2017; Tomaszewski *et al.*, 2019; Zukerman *et al.*, 2022). Therefore, there is a strong interest in identifying factors that may contribute to improved functioning and adaptive behaviour.

Functioning in adults with ASD-1, as mentioned, could be related to the process of transition to adulthood. For people with ASD, in general, this process is highly challenging (Rydzewska, 2012; Nicholas *et al.*, 2017). The literature indicates that an adequate transition process for this population depends on the amount of support provided (Fuentes *et al.*, 2020). However, one of the major barriers they face is the diminishment and even lack of intervention services that fit their characteristics and needs (Anderson *et al.*, 2022; Anderson *et al.*, 2018; Austermann *et al.*, 2023; Hurley-Hanson *et al.*, 2020; Rydzewska, 2012; Scott *et al.*, 2019). Besides, there is

weak evidence on the efficacy of treatments for adults with varying degrees of ASD affectation (Fuentes *et al.*, 2020; Lord *et al.*, 2020). Therefore, it is to be expected that people with ASD-1 will have difficulties in their transition process to adult life.

Considering that it is important to develop appropriate interventions and support systems for the ASD-1 population (Schmidt *et al.*, 2015), the aim of this narrative review is to compile the main recent empirical findings on the factors associated to adult functioning. As a main hypothesis, it is considered that various intrinsic factors (typical of the characteristics of people with ASD) and environmental factors are involved in the functioning of this population.

2. Methodology

As part of the doctoral thesis *Variables involved in the academic and occupational functioning and satisfaction of adults with Autism Spectrum Disorder level 1*, a bibliographic search was carried out in the UNIKA reference aggregator of the University of Navarra using the following keywords: autism OR ASD OR Asperger's OR "autism spectrum disorders" OR "high functioning autism"; AND adapt* OR "psychosocial functioning" OR satisf* OR "life satisf*" OR "daily li*" OR "daily function*" OR participa*; NOT famil* OR Child* OR Parent* OR sibling* OR ADHD.

Articles, dissertations, and books related to the subject, between 2011 and 2020, in English and Spanish, were selected from a total of 14 Psychology databases: APA PsycInfo, APA Psyarticles, Social Science Citation Index, Psychology and Behavioural Science Citation, Networked Digital Library of Theses, Medline, Eric, Scopus, Dialnet, Scielo, University of Navarra, APA PsyBooks, Psychiatric online and Francis Archive.

The search yielded a total of 7729 records, of which, based on an initial screening (reading titles and abstracts), 558 were selected according to the following inclusion criteria: adults (over 18 years old) with ASD without intellectual disability; psychosocial functioning and variables that influence ASD; adaptive behaviour, adaptive skills, self-determination, social participation, and daily living skills; life satisfaction and quality of life; late diagnosis; differences between men and women with ASD; support services for adults with ASD; and mental health and ASD.

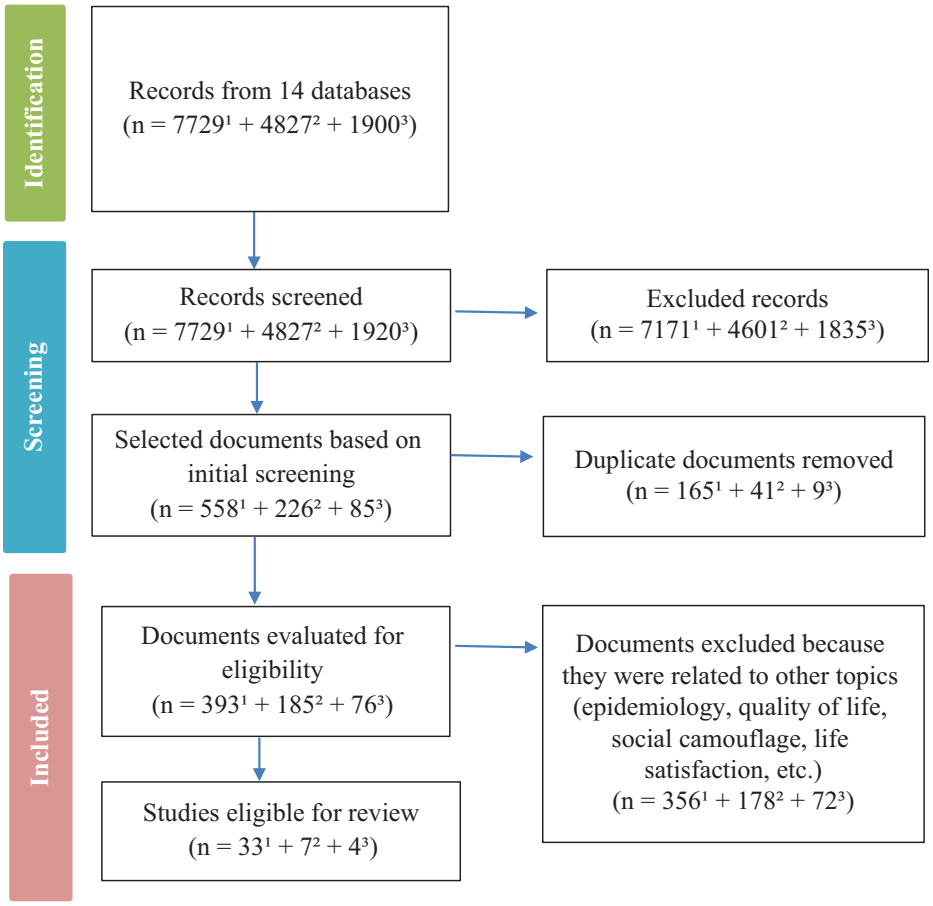
After removal of the repeated articles, a total of 393 documents remained. Subsequently, these were classified by themes: epidemiology, mental health, quality of life, functioning, adaptive behaviour, life satisfaction, social participation, late diagnosis, social camouflage, differences between men and women with ASD, support services or interventions, transition to adult life, and COVID 19.

For this article, only studies that referred to the following themes were included: social functioning, and adaptive behaviour. As well, due to its relationship with these concepts, transition to adult life was also included. Therefore, a total of 33 documents were selected. We repeated the search twice to locate noteworthy publications related to the functioning of adults with ASD-1. The first one was on February 9th, 2024, with time restrictions: from January 2021 to February 2024. Out of a

total of 4827 records, 226 documents were selected (following the inclusion criteria), of which 41 were removed because they were duplicate articles. Of the 185 articles evaluated for eligibility, only seven were included in this manuscript. The second one was on January 20th, 2025, with time restrictions: from February 2014 to January 2025. Out of a total of 1900 records, 85 were selected, of which nine were removed. Of the 76 articles evaluated for eligibility, four were finally included.

Thus, a total of 44 articles were reviewed in the first, second and third search (Tables S1, S2). The flow chart of the screening process is on Figure 1.

FIGURE 1. Diagram of the process of searching and selecting articles



Notes: ¹First search; ²Second search; ³Third search.

3. Results

3.1. *Functioning and Transition to Adulthood of People with ASD-1*

According to research, supports are necessary for an adequate transition to adulthood, and appropriate functioning for people with autism. The design and execution of transition plans during high school as part of the Individualized Education Program (IEP), and transition to employment programs out of school, are supposed to make up for the diminishment or lack of intervention services for young people with ASD (including ASD-1). The aim of these services should be to train functional skills so this population can function independently (Anderson *et al.*, 2022; Chandroo *et al.*, 2018; Hurley-Hanson *et al.*, 2020; Schall *et al.*, 2014; Test *et al.*, 2014; Wehman *et al.*, 2014; Rydzewska, 2012).

As a main recommendation, transition plans and programs should be individualized (Anderson *et al.*, 2018; Test *et al.*, 2014), focusing primarily on the strengths, preferences, and interests of each person with ASD (Anderson e*t al.*, 2022; Schall *et al.*, 2014). However, they should have certain objectives in common to promote better performance in adult life. Specifically, they should focus on developing skills such as self-determination, self-management, autonomy, professional development and adaptative behaviour (Anderson *et al.*, 2022; Anderson *et al.*, 2018; Chandroo *et al.*, 2018; Kraemer *et al.*, 2022; Schall *et al.*, 2014; Test *et al.*, 2014; Wehman *et al.*, 2014).

About *self-determination*, it is crucial that people with ASD-1 learn to communicate their choices, ask for help, request breaks when they are overwhelmed, and maintain attention with people they are interacting with, among others. In terms of *self-management* of behaviour, it is essential that students with ASD learn to monitor their own behaviour and have their own support strategies. In terms of *autonomy*, it is important to help them acquire skills that they will need when they transition to adulthood (e.g., communication skills); to this end, it is vital that they are exposed to experiences in community, post-obligatory education and/or work environments to experience what it means to work in certain areas. In the *professional field*, coherence between strengths, preferences and interests with the chosen profession, and having clear employment goals, should be promoted. Finally, it is important to improve *adaptative behaviour* skills, because they are associated with a higher quality goals after graduating from school, that include employment, education and independent living areas.

Specifically, in high school settings, the access to recreational and leisure activities, that align with the interests and future goals of people withs ASD-1, should be facilitated. This would favour their learning about themselves and socialization (Test *et al.*, 2014). Moreover, the design of transition plans should also ensure this population have access to learning opportunities that promote real growth, while considering their particular characteristics (Kraemer *et al.*, 2022; Test *et al.*, 2014). Therefore, it is important to guarantee a general education inclusion (Feldman and Daviso, 2018; Hurley-Hanson *et al.*, 2020), where personalized supports and the provision of effective accommodations

and instructions will be built up as they transition into adult life (Schall *et al.*, 2014). Likewise, it is relevant to encourage their active participation in the planning and organization of transition plans so that they can aspire to continue with their academic training or enter the labour market once they finish secondary school (Hurley-Hanson *et al.*, 2020; Kraemer *et al.*, 2022; Wehman *et al.*, 2014).

Outside of the school setting, it is crucial to maintain a support system through post-secondary transition programs, like vocational rehabilitation services or community rehabilitation programs (Hurley-Hanson *et al.*, 2020; Schall *et al.*, 2014), which should integrate, as some of their intervention targets: vocational counselling (Schall *et al.*, 2014), interview skills training (Anderson *et al.*, 2022), job placement assistance and on-the-job training and supports (Hurley-Hanson *et al.*, 2020; Schall *et al.*, 2014) that help ASD-1 people to secure and maintain a job.

The involvement of family, teachers, and peers is essential for people with ASD-1 to achieve better functioning in adult life (Barahona-Correa, 2017; Nicholas *et al.*, 2017; Test *et al.*, 2014). In the case of parents/tutors, they are expected to have a less active role, in order for their children to gain greater independence, without this meaning that all support resources must be withdrawn; rather, they are expected to have new role models (teachers, classmates, bosses, etc.) who can guide them in their transition process (Anderson *et al.*, 2018). Finally, it is essential to continue raising awareness about ASD to promote an "autism-friendly environment" and a supportive culture (Anderson *et al.*, 2018; Henninger and Lounds Taylor, 2012).

Considering the importance of the implementation of transition plans, Chandroo *et al.* (2018) conducted a systematic review on the level of participation of students with ASD-1 in this type of service; they found that they tend to be minimally active involved in the planning process or do not attend IEP meetings. The lack of clear information on the objectives and procedures to be followed during the meetings, and the lack of preparation of the educators responsible for supporting students with ASD-1, are two barriers detected. In reference to this last point, it seems to be few interventions and methods to train professional at improving the quality of goals of transition plans (Bahry *et al.*, 2024). This is line with a study, where adults with ASD-1 reported being active in selecting colleges (where they subsequently attended), but they did not receive robust transition services in high school, specially, they missed experiences focused on developing independent living or social skills (Austermann *et al.*, 2023).

In outside school services, research points out that a good support network lets ASD-1 people to have a more positive subjective transition experiences within educational or employment contexts (Davidovitch and Gerkerova, 2024; Wehman *et al.*, 2014). In contrast, a lack of support its related with poor mental health (Anderson *et al.*, 2022). Therefore, it is crucial to keep improving transition services.

3.2. *Variables Involved in Social Functioning in Adults With ASD-1*

In some studies, it has been found that only between 3 and 12 % of the population with ASD-1 completes university studies (Flower *et al.*, 2021; Ojea and Diéguez,

2016). Additionally, a large majority are unemployed (Hurley-Hanson *et al.*, 2020; Solomon, 2020) or work in positions that do not correspond to their educational qualifications, which tend to exceed the characteristics required for the job profile (Bruyere *et al.*, 2020; Hurley-Hanson *et al.*, 2020). In the realm of social relationships, less than half of adults with ASD-1 report having friendships or a romantic relationship despite their desire to interact with others (Henninger and Lounds Taylor, 2012; Howling and Magiati, 2017; Schall *et al.*, 2014; Wehman *et al.*, 2014). Finally, there are high percentages of adults with ASD-1 who depend on their parents, relatives, or the government for assistance (Henninger and Lounds Taylor, 2012; Howlin and Magiati, 2017; Schall *et al.*, 2014), despite of emancipated living, in some cases (Howlin and Magiati, 2017), having a stable job or participating in social activities (Henninger and Lounds Taylor, 2012).

These outcomes are related with different factors, that have been grouped into demographic, neurocognitive, autism-intrinsic, socio-environmental, and other factors.

Demographic Factors. Eight articles analysed in the systematic review by Zimmerman *et al.* (2018) studied the relationship between age, gender, and functioning in adults with ASD-1. Only in one study did older age correlate negatively with social functioning. As similar finding was reported by Kirby *et al.* (2016), specifically between age and social relationship domain. In contrast, in the initial stage of the longitudinal study by Scheeren *et al.* (2022), older age predicted higher levels of social functional. Although, in the last stage, age did not predict more growth in social functioning. According to the authors, older adults may have had more time to reach certain milestones.

With respect to gender, in two reviews noting that men with ASD-1 are more likely to be employed or access post-obligatory education than women with ASD-1 (Howlin and Magiati, 2017; Zimmerman *et al.*, 2018). They also reported greater well-being in their relationships compared to women (Zimmerman *et al.*, 2018). However, recent studies find that women are more likely to have socially valued roles (like intimate relationships and post-obligatory education) than men, although more of them are also expected to have poorer mental and physical health too (Dubreucq *et al.*, 2023). On the other hand, other studies did not find a significant relationship between gender and functioning in adults with ASD-1 (Kirby e*t al.*, 2016; Mason *et al.*, 2020; Scheeren *et al.*, 2022).

Neurocognitive Factors. Most literature reviews and systematic reviews mention that there is a consistent correlation between intelligence quotient (IQ) and social functioning in adults with ASD (Howlin and Magiati, 2017; Kirby *et al.*, 2016; Levy and Perry, 2011; Zimmerman *et al.*, 2018). However, a recent meta-analysis concluded that while higher IQ is a protective factor against poor functioning, it is not a consistent predictor of good functioning (Mason *et al.*, 2020). Therefore, although some adults with ASD-1 with preserved IQ manage to live partially independent lives, they may still experience significant obstacles in other aspects of their lives (Posar and Visconti, 2019; Ratto and Mesibov, 2015). It is common, for example, that they are able to get a job, but have difficulty keeping it (Barahona-Correa, 2017; Mason *et al.*, 2020), due to the challenges inherent to the diagnosis of ASD.

On the other hand, it is possible that early diagnosis of ASD together with the supports received moderates the relationship between higher IQ and better functioning (Scheeren *et al.*, 2022).

Regarding other neurocognitive factors, Zimmerman *et al.* (2018) found a positive association between social cognition and the quality of interpersonal relationships. Bishop-Fitzpatrick *et al.* (2016) observed that adults with ASD-1 who scored better on executive function tasks reported better functioning in the workplace and better mental health. However, most of them continued to live with their families and depend to some degree on them. These results are in line with those described in the review by Hume *et al.* (2014), which points out that difficulty in independent functioning is related to a deficit in executive functions.

Early language development (Howlin and Magiati, 2017; Levy and Perry, 2011; Posar and Visconti, 2019) and cognitive language use (Dubreucq *et al.*, 2023) also appear to be significantly related to improved social functioning in adults with ASD-1. Although, cognitive language use was also related with higher frequency of co-occurring mental problems, possibly because verbal ability its related with a higher insight into autism-related challenges (Dubreucq *et al.*, 2023).

In the study by Otsuka *et al.* (2017), a multiple linear regression analysis revealed that adaptive behaviour was the only significant predictor of social functioning, explaining 64 % of the variance. On the other hand, Bishop-Fitzpatrick *et al.* (2016), applying a multimodal logistic regression model, found that better performance in daily living skills (adaptive behaviour dimension) predicts adults with ASD-1 being among the "best independent living" group.

Intrinsic Factors of Autism. The level of severity of ASD symptomatology is considered a predictor of difficulties in social functioning (Dubreucq *et al.*, 2023; Howlin and Magiati, 2017; Helles *et al.*, 2017; Hume *et al.*, 2014; Kirby *et al.*, 2016; Scheeren *et al.*, 2022; Zimmerman *et al.*, 2018). Therefore, it is expected that adults with ASD-1, who have milder symptoms, will have better functioning, compared to those with ASD with more severe symptoms.

In fact, some studies that have looked at the level of functioning according to the DSM IV classification of autism, concluded that classic or infantile autism has a greater relationship with poor or very poor functioning, compared to those with Asperger's Syndrome (AS), high-functioning autism or atypical autism (Posar and Visconti, 2019). These results are in line with the meta-analysis by Mason *et al.* (2020) in stating that although not enough data were obtained to determine whether the autism subtype was a good predictor of functioning, a low proportion of participants with classic autism belonged to the "good functioning" group, while those who were diagnosed with ASD (which included AS) were less likely to belong to the "poor functioning" group.

However, it is common that people with ASD-1 keep showing difficulties in achieving and maintaining friendships or a partner (Helles *et al.*, 2017; Ratto and Mesibov, 2015), getting a job or living independently (Helles *et al.*, 2017) due to their difficulties in social communication. Moreover, they tend to be diagnosed with mental health diagnosis such as depression and anxiety (Howlin and Magiati, 2017;

Levy and Perry, 2011; Posar and Visconti, 2019), despite presenting improvements in ASD symptoms.

Socio-environmental Factors. To have a more objective view of the social functioning of adults with ASD-1, the influence of family, school, and society has been studied (Anderson *et al.*, 2018; Henninger and Lounds Taylor, 2012).

There are findings in regards to the educational level of parents (Zimmerman *et al.*, 2018), their socioeconomic level, the expectations they have of their children with ASD-1 and their level of involvement in their education (Bishop-Fitzpatrick *et al.*, 2016; Kirby *et al.*, 2016) is associated with higher odds of getting a job in adulthood. It is crucial that during the transition process to the adult life of their children with ASD-1, parents adjust to the challenges of this stage since, otherwise, they could limit them in their process of achieving good functioning (Anderson *et al.*, 2018).

On the other hand, the positive perception of "informal" support (from friends, the community, etc.) also seems to be related to better social functioning, specifically with better affective relationships (Zimmerman *et al.*, 2018).

Finally, support services, such as career counselling, have also been found to be predictors of good functioning (Kirby *et al.*, 2016). It is important that these are tailored to the individual needs of people with ASD-1 as they could otherwise be limiting (Anderson *et al.*, 2018).

Other factors associated with functioning. It is possible that the concept of good functioning does not fit with the needs that are relevant to people with ASD, so it is suggested to measure factors that reflect the perception of this population regarding their living situation (Henninger and Lounds Taylor, 2012; Howlin and Magiati, 2017).

Scheeren *et al.* (2022) found a positive relationship between subjective quality of life (related to satisfaction) and social functioning, at least in the first two years of follow-up. However, in a two-decade follow-up study, adults with ASD-1 reported adequate subjective quality of life, despite most did not live independently or have full-time employment (Helles *et al.*, 2017).

Bishop-Fitzpatrick *et al.* (2016) found that good functioning does not necessarily imply having an objective good quality of life (measured through indicators of physical health, mental health, neighbourhood quality, and family contact), and vice versa. In fact, adults with ASD-1 who lived independently and had a job reported greater mental health problems. However, more recent studies found a relationship between low levels of quality of life (highlighting the mental health indicator) and a poor social functioning (Dubreucq *et al.*, 2023; Leader *et al.*, 2021; Scheeren *et al.*, 2022)

3.3. *Variables involved in adaptive behaviour in adults with ASD-1*

Studies indicate that adults with ASD-1 tend to score significantly lower in the domain of "socialization" (Matthews *et al.*, 2015; Williams *et al.*, 2014). In particular,

the subdomain of "interpersonal relationships" or "social relationships" appears to be a substantial weakness (Kenworthy *et al.*, 2010; Kraper *et al.*, 2017; Matthews *et al.*, 2015); Therefore, they tend to have significant difficulties in establishing friendships, in pragmatic language, awareness of emotions, social judgment, and courtesy skills. A study using WHODAS also found that in domains involving interaction with others, adults with ASD-1 presented significant difficulties compared to their neurotypical peers (Schmidt *et al.*, 2015).

In the "daily living skills" (DLS) domain, adults with ASD-1 tend to excel (Matthews *et al.*, 2015, 2017; Otsuka *et al.*, 2017; Schmidt *et al.*, 2015) and may even achieve similar performance as their neurotypical adult peers (Schmidt *et al.*, 2015). On the other hand, Bal *et al.* (2015), in a longitudinal study, found that the progress of DLS (measured with the Vineland) slows down when transitioning to adult life. For these authors, the results would reflect changes in the expectations of family members (who play the role of informants) and would not necessarily mean a loss of skills.

Performance in each of the DLS subdomains appears to vary and be influenced by the type of test used. In the study by Kraper *et al.* (2017), adults with ASD-1 excelled in the subdomain "domestic life", measured by the ABAS, and their performance in the subdomains "utilization of community resources" and "health and safety" was considered a relative strength. When the Vineland was used, they performed substantially lower in the "community" subdomain, which involves the skills to function autonomously in the place where one lives, the planning and organization of daily activities, and the knowledge of citizens' rights and duties (Matthews *et al.*, 2015). On the other hand, Bal *et al.* (2015) observed that performance decreases especially in the subdomain "domestic skills" when transitioning to adult life. It is possible that these differences between study results are related not only to the use of different assessment instruments, but also to the number of participants and their ages.

In the case of the "communication" domain, adults with ASD-1 significantly excelled in the "written language" subdomain (Kraper *et al.*, 2017; Matthews *et al.*, 2015).

Some longitudinal studies have found that, although the levels of adaptive behaviour achieved by adults with ASD-1 are lower than those achieved by their neurotypical peers, there is a trend towards significant improvement as they transition into adulthood (Bal *et al.*, 2015; Tomaszewski *et al.*, 2019; Zukerman *et al.*, 2022).

To better understand which factors, influence a higher or lower level of adaptive behaviour, the role of different sociodemographic, psychological, and environmental variables was analysed.

Demographic Factors. Several studies have explored the relationship between age and the level of adaptive behaviour. Matthews *et al.* (2015, 2017) found that adults with ASD-1 have worse communication and social skills than their adolescent peers with ASD-1. In addition, the difference in levels of adaptive behaviour is greater between the group of adults with ASD-1 and their neurotypical peers than that between adolescents with ASD-1 and their peers without ASD. According

to these authors, these results indicate that the adaptive behaviour of people with ASD-1 does not develop at the rate of chronological age and that this difference increases over the years (Matthews *et al.*, 2017).

Despite these results, comparative analysis between the scores of adolescents and adults with ASD-1 in each of the questions that make up each domain of adaptive behaviour, shows that adults obtained better scores (therefore, better independent functioning) in four items of the "communication" domain, nine of the "daily living skills" domain and five of the "socialization" domain, compared to that of their adolescent peers (Matthews *et al.*, 2017). They concluded that people with ASD-1 do not lose adaptive skills with age, but develop them more slowly, especially those corresponding to the domains of "communication" and "socialization" (Matthews *et al.*, 2015).

Williams *et al.* (2014) found that adults with ASD-1 (ages 21 to 46) scored significantly higher than their school-aged peers (ages 8 to 12) in the "daily living skills" domain. The authors point to the possibility that there is a positive influence of intervention programs on daily living skills. However, more longitudinal studies are needed to analyse this issue in greater depth.

On the other hand, Kenworthy e*t al.* (2010) and Kraper *et al.* (2017) found no significant correlations between age and adaptive behaviour. In both cases, ABAS was used as a measuring instrument.

Neurocognitive Factors. Similar to studies in children and adolescents (Alvares *et al.*, 2020; Kanne *et al.*, 2011), the intelligence quotient (IQ) of the adult population with ASD-1 tends to be significantly higher than the level of adaptive behaviour (Kenworthy *et al.*, 2010; Kraper *et al.*, 2017; Matthews *et al.*, 2015). It has also been observed that the gap between the two constructs tends to increase with age (Matthews *et al.*, 2015). Despite these results, a significant correlation has been found between IQ and adaptive behaviour (Otsuka *et al.,* 2017), especially with the domains "communication" (assessed with the Vineland scales) (Matthews *et al.*, 2015) and "conceptual" (measured with the ABAS) (Kenworthy *et al.*, 2010; Zukerman *et al.*, 2022). In terms of communication skills, IQ was positively correlated with performance in the "writing skills" subdomain. It also appears that these correlations are consistent from childhood to adulthood (Kenworthy *et al.*, 2010; Matthews *et al.*, 2015).

The longitudinal study by Bal *et al.* (2015) concluded that receptive language, together with nonverbal IQ and symptomatology level, predict a better level of daily living skills in the ASD-1 population. Different executive functions measured with the BRIEF (such as self-regulation, metacognition, cognitive flexibility, organization, and planning, among others) positively correlated with scores in adaptive behaviour measured with the ABAS obtained by youth with ASD-1 (Peterson *et al.*, 2015; Sullivan *et al.*, 2024). Some authors hypothesize that low executive functions may explain the gap between IQ and adaptive behaviour in people with ASD-1 (Matthews *et al.*, 2017). However, recent research found that executive function accounted for only 3.4 % of the variance in adaptative behaviour (Sullivan *et al.*, 2024).

Williams *et al.* (2014) studied the performance on measures of conceptual reasoning, problem-solving, and adaptive behaviour of adults with ASD-1 and neurotypical,

and the relationship between these variables. They found that, in the experimental group, one of the components of conceptual reasoning, "flexible thinking," correlated positively with adaptive behaviour, whereas, in the control group, the correlation between these constructs was negative. Therefore, it is possible that difficulties in cognitive flexibility better explain difficulties in adaptive behaviour in the ASD-1 population. However, they also noted that the experimental group showed similar performance to their neurotypical peers in problem-solving tasks, which were evaluated in laboratory environments, in a predictable and controlled manner. Therefore, it could be hypothesized that difficulties in cognitive flexibility are only seen in real-life situations (Williams *et al.*, 2014).

In the field of social cognition, a positive correlation was found between adaptive behaviour and emotion recognition (Hudepohl *et al.*, 2015; Otsuka *et al.*, 2017). Hudepohl *et al.* (2015) pointed out that a low score in the domain of "socialization" would be better explained by a deficit in the perception of emotions and, therefore, it would be important to include it as an intervention objective. On the other hand, Otsuka *et al.* (2017) found that the perception of emotions explained 35 % of the variance in adaptive behaviour, constituting a significant predictor. In relation to this, Hervas and Romarís (2019) mention that adults with ASD-1 tend to use compensatory strategies to minimize their difficulties in social cognition.

Finally, positive correlations were also found between adaptive behaviour and other neurocognitive dimensions such as long-term memory, processing speed, and verbal fluency; the latter was a significant predictor of adaptive behaviour, explaining 47 % of its variance, with the perception of emotions being the main mediator between them (Otsuka *et al.*, 2017). According to the authors, one possible interpretation is that, in adults with ASD-1, high verbal fluency would contribute positively to the processing of other people's emotions, which would impact adaptive behaviour.

Intrinsic Factors of Autism. The correlation between adaptive behaviour and ASD symptomatology seems to be influenced by the diagnostic instrument used. For example, Kenworthy *et al.* (2010) found a negative correlation between the "communication" domain of ADOS and all domains of ABAS; however, they found no correlations between symptomatology measured with the Social Responsiveness Scale (SRS) and ABAS components. On the other hand, Kraper *et al.* (2017) found that the correlation between adaptive behaviour (assessed with the ABAS) and ASD symptomatology (measured with the SRS) was mediated by the mental health variable. In this way, they concluded that a high level of symptomatology is related to mental health problems, and that these two variables, in turn, have a negative impact on the adaptive functioning of adults with ASD-1. These findings are congruent with those of Schmidt *et al.* (2015), who suggest that mental health problems, such as anxiety and depression, correlate with low psychosocial functioning. In turn, improvements in adaptive behaviour are related to improvements in mental health (Zukerman *et al.*, 2022).

On the other hand, it seems that autism symptomatology influences negatively in the effective use of compensatory resources to function adequately in their environment.

For example, an adult with ASD may have difficulty using imitation as a resource to resolve a situation in which it is not clear what to do (Hervas and Romarís, 2019).

Socio-environmental Factors. Tomaszewski *et al.* (2019) conducted a longitudinal study, where one of the objectives was to measure the influence of the educational environment on the adaptive behaviour of young people with ASD (from 14 to 20 years old, 72 % had ASD-1). They found that those who scored high on the "independence" domain of the Autism Program Environment Rating Scale (APERS) improved their communication skills and daily living skills. Recent research found similar findings in young adults who participated in a training program, but in this case, improvements were in overall adaptative behaviour skills (Louksy *et al.*, 2024). These findings were replicated in university students with ASD-1, who improved their communication skills after one year of participating in an integration program (Zukerman *et al.*, 2022). Therefore, the support strategies employed by the mentors seem to have a positive influence on the adaptive development of this population.

Other factors associated with adaptive behaviour. Schmidt *et al.* (2015) found that the "participation in society" domain of the WHODAS is related to life satisfaction. Therefore, the ability to participate in social or community activities, and the barriers experienced from the environment are what influence the degree of satisfaction of adults with ASD-1.

4. Conclusions

According to the literature reviewed, multiple factors may be involved in the social functioning and adaptive behaviour of adults with ASD-1.

Functioning is closely related to the implementation of transition to adulthood programs. Regarding its application in the ASD-1 population, two important aspects can be appreciated. First, some proposals do not seem to fit the needs of this population, which would explain the low rate of their active participation (Anderson *et al.*, 2022; Chandroo *et al.*, 2018; Kraemer *et al.*, 2022), although there are guidelines for its proper implementation (Anderson *et al.*, 2018; Hurley-Hanson *et al.*, 2020; Schall *et al.*, 2014; Test *et al.*, 2014; Wehman *et al.*, 2014). Secondly, they may focus more on aspects of academic-work and community life than on personal aspects, such as friendships and relationships (Austerman *et al.*, 2023). Higher quality of training by professionals responsible for transition services seems to be the key to improve functioning of adults with ASD-1 (Davidovitch and Gerkerova, 2024; Lousky *et al.*, 2024).

The results of many studies appear to be inconclusive regarding the influence of age on social functioning and adaptive behaviour. Other variables, such as opportunities to reach adulthood milestones (Scheeren *et al.*, 2022), could mediate the relationship between these two variables. With respect to the gender variable, mainly its relationship with social functioning has been analysed. It seems that men with ASD-1 have better results than their female peers. However, these differences have not been found in recent studies (Mason *et al.*, 2020; Scheeren *et al.*, 2022),

and in one of them, a better functioning was related with more mental health problems in women (Dubreucq *et al.*, 2023). It would be interesting to investigate upon the factors that may be behind these results.

On the other hand, everything seems to indicate that the IQ variable, on its own, is not useful for predicting social functioning and adaptive behaviour in adults with ASD-1. A longitudinal study highlighted that early diagnosis of ASD and supports moderates the relationship between IQ and improved social functioning (Scheeren *et al.*, 2022). Likewise, it is consistently observed that adaptive behaviour scores tend to be significantly lower than IQ scores obtained by adults with ASD-1, which are also significantly lower than those of their neurotypical peers (Kenworthy *et al.*, 2010; Kraper *et al.* 2017; Matthews *et al.*, 2015).

The literature suggests that other neurocognitive factors are better predictors than IQ of both social functioning and adaptive behaviour. In most cases, they seem to positively influence both types of functioning. For example, executive functions, social cognition (including emotion recognition), receptive and expressive language, and verbal fluency have been found to significantly influence the ability of adults with ASD-1 to have better adaptive behaviour, as well as to have employment, appropriate social relationships, and live independently.

In the case of adaptive behaviour, the predictability of these factors would be moderated by others; for example, receptive language, together with nonverbal IQ and the level of ASD symptomatology, would predict daily living skills (Bal *et al.*, 2015); and emotion recognition would mediate the predictive relationship between verbal fluency and adaptive behaviour (Otsuka *et al.*, 2017). Similarly, the correlation is observed between the level of severity of ASD symptoms and adaptive behaviour, and this is mediated by the mental health variable (Kraper *et al.*, 2017; Schmidt *et al.*, 2015). Therefore, it is necessary to study the influence of other neurocognitive factors, beyond IQ, on social functioning and adaptive behaviour to improve the care services available to this population.

In this review, few articles mentioned about the role of mental health in functioning (Anderson *et al.*, 2022; Dubreucq *et al.*, 2023; Kraper *et al.*, Schmidt *et al.*, 2015), despite there is a high prevalence of mental health disorders in ASD population (Lugo-Marín *et al.*, 2019). Difficulties in functioning would be expected to trigger psychiatric disorders like anxiety and depression (Barahona-Correa, 2017; Fuentes *et al.*, 2020). For that reason, it will be also important to explore this relationship in-depth.

To a lesser extent, the impact of environmental factors on performance has been investigated. The studies reviewed found that the level of parental involvement (Bishop-Fitzpatrick *et al.*, 2016; Kirby *et al.*, 2016) and peer or community support (Zimmerman *et al.*, 2018) are positively related to a better job position and social performance. The impact of support programs available to youth with ASD-1 in transition (Lousky *et al.*, 2024; Tomaszewski *et al.*, 2019) and adults with ASD-1 (Kirby *et al.*, 2016; Zukerman *et al.*, 2022) in social functioning and adaptive behaviour, show encouraging results. However, it is essential to carry out more studies with good methodological designs that address this issue to improve the weak evidence on the efficacy of treatments for adults with ASD (Fuentes *et al.*, 2020; Lord *et al.,* 2020).

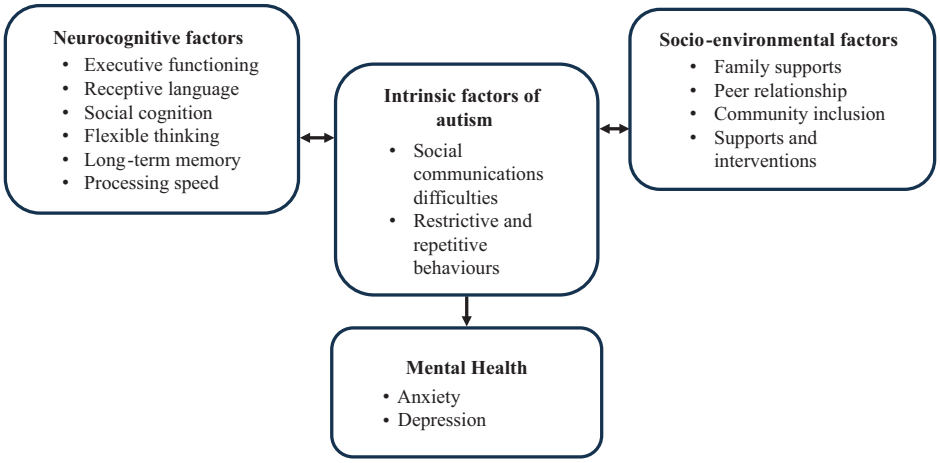
Given that functioning its related with transition to adulthood services, it would be helpful to make a review about effectiveness of support programs related with state policies like IEP or vocational rehabilitation services (Schall *et al.*, 2014), in conjunction with independence support services such as those mentioned in Lousky *et al.* (2024) and Zukerman *et al.* (2022).

It is worth emphasizing that adaptive behaviour appears to be a good predictor of social functioning (Bishop-Fitzpatrick *et al.,* 2016; Otsuka *et al.*, 2017). Specifically, one study found that daily living skills predict a higher standard of independent living (Bishop-Fitzpatrick *et al.*, 2016). It would be interesting to analyse the relationship between the different specific domains of adaptive behaviour and other components of functioning.

Finally, considering that multiple factors –both intrinsic (e.g., demographic and neurocognitive characteristics) and extrinsic (e.g., family environment and support systems)– influence functioning, and that some studies have identified moderating or mediating effects of specific variables, highlighting their interdependent nature, it is essential to conduct research that examines these elements as part of a dynamic system. The conceptual model included in this review (Figure 2) visually summarizes these relationships and may inform future research and intervention approaches grounded in a multidimensional framework.

One limitation of this review is that it did not include studies on quality of life. According to Lord *et al.* (2020), functioning is an objective quality of life measure, because this includes normative standards of a person's condition; however, it is a multidimensional and complex concept that includes subjective aspects too. In this regard, some authors point out that there is a lack of consensus on how to measure

FIGURE 2. Possible interaction between neurocognitive, intrinsic and socio-environmental factors, all related to function in ASD population



functioning holistically in people with ASD-1 (Bishop-Fitzpatrick *et al.*, 2016; Henninger and Lounds Taylor, 2012). It will be interesting to make another review about quality of life of people ASD-1 to delve deeper into their current reality.

On the other hand, because this is a narrative review article, it has a higher risk of bias than a systematic review; so, some studies related to functioning may not have been included. In the same line, this review did not include a quality or bias assessment; this is acknowledged as a limitation and the findings should be interpreted with caution. However, a qualitive appraisal was applied by considering study design: greater weight was given to meta-analyses, systematic reviews, longitudinal studies; medium weight to cross-sectional studies; and lower weight to narrative reviews. It is noteworthy that information provided by lower-quality studies were consistent with the findings reported in higher-quality evidence, which support overall conclusion.

According to a recent prevalence study, people with ASD-1 make up for 63 % of the population with autism (Maenner *et al.*, 2023). Their communicative, social, and behavioural characteristics differ from those of their peers with coexisting intellectual disabilities (APA, 2013), and the level of their social functioning and adaptive behaviour appear to be more changing and less predictable than previously believed (Otsuka *et al.*, 2017). Therefore, it is necessary to carry out specific research, focused on the population of adults with ASD-1, which addresses all factors related to functioning, with special emphasis on socio-environmental variables, to respond to the needs of this population, especially when they transition to adult life. Specifically, longitudinal studies, focused on young people withs ASD-1 (according to DSM-5 criteria), that examine changes in social functioning and adaptative behaviour over time, as well as the personal and environmental factors associated with these changes (Figure 2), are recommended.

The contribution of this literature review is that it collected up-to-date information on the variables involved in the functioning of adults with ASD-1. Most literature reviews (Anderson *et al.*, 2018; Henninger and Lounds Taylor, 2012; Howlin and Magiati, 2017; Levy and Perry, 2011; Posar and Visconti, 2019; Ratto and Mesibov, 2015), systematic reviews (Kirby *et al.*, 2016) and meta-analyses reviewed (Mason *et al.*, 2020) include adults with ASD with different levels of impairment in their sample. Although it is possible to obtain relevant information from these documents on the functioning of adults with ASD-1, it is not clear to what extent the results presented can be generalized (Zimmerman *et al.*, 2018). Therefore, it would be relevant to carry out systematic reviews and meta-analyses that provide specific information on the functioning of the population with ASD-1.

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6. Core Terms

Transition to adulthood: a process that it is traditionally marked by the gradual emergence of objective demographic indicators, such as post-obligatory education, adult relationships, employment, and independent living, which entail different levels of challenges and require different types of skills, like adaptative behaviour.

Social functioning: social achievements that are expected in adulthood. It is traditionally measured using three domains: "Social Relationships," "Employment," and "Independent Living".

Adaptative behaviour: person's ability to complete tasks of daily living.