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Diagnostic Tests for Autism Spectrum Disorder in Morocco

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Abstract: The diagnosis of autism is based on the cross observations of several professionals and a multidisciplinary team (MDT) specialized in different situations. This research aims to establish a state of the art on the diagnostic and screening tests used by professionals in the United States, Canada, and France to determine the situation of the disorder in Morocco. Through interviews with 20 autism professionals from the three countries and Morocco specifically, as well as the review of 20 scientific articles, our study could identify the diagnostic and screening tools most used in the abovementioned countries.

Keywords: diagnosis, autism, multidisciplinary team, tests, screening.

摩洛哥自闭症谱系障碍的诊断测试

摘要：自闭症的诊断是基于多位专业人士和专门针对不同情况的多学科团队的交叉观察。这项研究旨在确定美国、加拿大和法国的专业人员使用的诊断和筛查测试的最新技术水平，以确定摩洛哥的疾病状况。通过采访来自这三个国家和摩洛哥的20名自闭症专业人士，以及对 20 篇科学文章的回顾，我们的研究可以确定上述国家最常用的诊断和筛查工具.

关键词：诊断、自闭症、多学科团队、测试、筛查.

1. Introduction

Autism and pervasive developmental disorders (PDD) are neurodevelopmental disorders that appear in the first years of life. Today, international classifications no longer use the notion of Pervasive Developmental Disorder (PDD) but the notion of autism spectrum disorder (ASD).

According to the International Classification of diseases (ICD 10) established by the World Health Organization (WHO), the diagnosis is based on a triad of symptoms.

According to the Diagnostic and Statistical Manual of Mental Disorders [1], published by the American Psychiatric Association, autism is manifested by qualitative alterations in social interaction and communication and by a repertoire of restricted and repetitive interests and activities.

The origin of autism is unknown and multifactorial. Some researchers believe that there are genetic factors as well as environmental factors [2].

Thus, the severity of symptoms varies from person to person in terms of the severity of the disorder. For this reason, there are several forms of autism.

However, two categories of the autistic disorder can

be distinguished in children: autism with intellectual disability and autism without intellectual disability. The latter is not characterized by language or behavioral disorders [3], which is why it is difficult to identify and diagnose.

According to the World Health Organization, it is estimated that one in 100 children has autism. This estimate is only an average, and the reported prevalence varies considerably from study to study.

Based on studies in North America and Western Europe, the prevalence of ASD overall is approximately 90 to 120 per 10,000 individuals. Boys are affected more than girls [4].

According to the High Authority on Health, the global prevalence of ASD (in people under 27 years of age) at 7.2/1000 in 2010, or 1/132 people.

The global prevalence of autism was estimated at 2.4/1000, with a predominance of males (3.6/1000) compared with females (1.2/1000).

In other qualitative studies, the median prevalence of ASD in Europe was estimated to be 6.2/1000 children (<18 years), and the median prevalence of autism was estimated to be 1.87/1000 children.

In the United States, according to the most recent Autism and Other Developmental Disorders Surveillance System report, over 337,000 children, the prevalence of ASD in 8-year-olds was estimated to be 14.7/1,000 in 2012, or 1/68 8-year-olds (23.6/1,000 in boys and 5.3/1,000 in girls.

These disorders affect 1.7% of American children, according to the U.S. The centers for Disease Control and Prevention (CDC) [5].

In France, the prevalence in 2003 among children under 7 years of age was estimated at 4.1/1000 for ASD, 0.7/1000 for infantile autism, and 0.1/1000 for Asperger syndrome.

The estimated prevalence of autism in Canada was 1 in 94 children and adults [5]. Among children and adolescents aged 5 to 17 years, approximately 1 in 66 children or youth have been diagnosed with ASD in Canada according to the 2018 National Autism Spectrum Disorder Surveillance System report is 1 in 66.

According to the NGO's estimates, globally, this condition has reached a prevalence rate of one in 50 births and affects 680,000 people in Morocco, including 12,800 births per year, which is 34 births per day.

In Morocco, there are approximately 338,000 to 563,000 people with autism. Additionally, ASD is 4 to 5 times more common in men than in women [6].

Across countries, the prevalence rates vary widely. The lack of hindsight does not allow us to determine a stable prevalence because of the great diversity of these ASDs (phenotype, care, etc.), which prevents us from precisely knowing the number of people with autism receiving support in the different sectors, health, medico-social, and who live at home. Autism can be confused with different disorders, which makes diagnosis difficult, especially in early childhood.

Researchers and clinicians state that the main symptoms of the disorder could not be adequately recognized to establish a reliable and valid diagnosis before the age of 6 to 10 years. There is no method that accurately detects the disorder in children 6 to 12 months of age [7].

Diagnosis relies on a combination of clinical observations by specialists and interviews with parents to identify red flags and initiate a personalized intervention plan.

Currently, the diagnosis of autism spectrum disorder (ASD) is a daunting and time-consuming process that requires a multidisciplinary team skilled in evaluating behavioral, historical, and parent-reported information to determine a diagnosis [8].

In Morocco, to diagnose autism, the child undergoes an assessment, specific tests, and a set of interviews with the parents with a multidisciplinary team specialized in the accompaniment of people with autism, which consists of a psychiatrist, child psychiatrist, pediatrician, neurologist, speech therapist, psychometrician.

Following the results of the evaluation, the parents are registered on a list of the rehabilitation centers for intellectual disabilities and pervasive developmental disorders of their city in the Harouchi clinic.

Retrospective studies indicate that most parents discover symptoms of autism by the second birthday, and one- third of parent's report uncertainties before the first birthday, with the disorder being detected by the fourth year of life or later [9].

Overall, the diagnostic process is extremely stressful, especially for parents of children with more severe ASD [10].

Recently, several ASD assessment instruments have been developed that differ according to the age and pathology of the target population, the goals of the assessment (diagnosis, progression monitoring, prediction, or research), the type of assessment (direct patient observation, parent interview, professionally completed questionnaire), the time to complete and score, and whether specific training is required. [11].

There are many reasons for this trend and including advancing knowledge of how to make a diagnosis, the heterogeneity of the spectrum, the realization that different methods may be needed depending on age and intellectual disability [12].

Several procedures have been used for the early identification of autism. Some methods, such as home videos and experiments to determine toddlers' responses to stimuli, have been useful in alerting clinicians and researchers to the content of diagnoses.

Other methods, particularly those derived and empirically tested, have been used for the early identification of children with autism and for early

diagnosis [13].

Incorrect diagnosis of ASD (false positive result) can cause family stress, lead to unnecessary investigation and treatment, and place greater strain on already limited-service resources [14].

Delayed identification may be related to several factors, including low rates of ASD screening, inferior performance characteristics of ASD screening instruments in "real-world" practice, and barriers to timely evaluation of ASD-positive children [15].

Autism is still little known by Moroccans. And since ignorance often leads to mistrust, some people with this disorder are marginalized, especially in rural areas, even though they are entitled to financial and human assistance to compensate for the expenses related to their child's disability.

Our goal is to make our community aware of the autism assessment process and the tests used in Morocco and those used in other developed countries to build a more informed society.

1.1. Objectives of the Study

This study aims to identify the autism diagnostic tests used in Morocco to optimize the diagnostic procedures and the use of the most effective instruments to choose the most appropriate instrument for the Moroccan context.

1.2. Research Questions

What is the current situation of autism in Morocco compared to other countries?

2. Research Methods

Our study is a qualitative and comparative systematic review that was carried out based on cross-sectional studies carried out by other specialists, researchers, and surveys conducted among general practitioners, child psychiatrists, speech therapists, psychiatrists, and psychometricians in different cities in Morocco as well as in other countries such as Canada, France, and the United States.

It focuses on the characteristics and usefulness of the set of diagnostic tools for autism practiced in Morocco by comparing them with other countries.

For relevant research, we examined 20 scientific articles using different databases, and we could identify the criteria of 23 tools for the evaluation and screening of autism.

Generally, the objective of this scientific article is to present the process of diagnosis of ASD in Morocco, as well as to describe and analyze the most recommended ASD assessment tools used by professionals in Morocco and in other countries such as Canada, France, and the United States to determine the situation of the disorder in Morocco.

It carries out a critical analysis based on criteria (objective, target population, type of test, administration, etc.) to identify the relevance of the tests used in our country.

2.1. Instruments

2.1.1. Questionnaires and Interviews

Regarding the instruments used in our study, we opted for questionnaires and interviews with autism specialists.

Among the criteria we used in our comparative study were the target populations, the purpose of the test, the type of test, the duration of the test, and the evaluator.

The purpose of the interviews was to obtain information about the diagnostic process for ASD and the screening tools used in Morocco and other countries.

To do this, we interviewed 20 autism professionals individually who contained different specialties. The questions were of a closed, open-ended nature.

2.1.2. Observation Methods

Observation is a mode of data collection by which the researcher observes from himself, processes, or behaviors taking place in an organization during a delimited period [16]. In applying the non-participant observation method, we attended debriefing interviews conducted by clinicians with parents of children with autism, which allowed us to maintain an external viewpoint.

The main steps of the research process are summarized in Fig. 1.

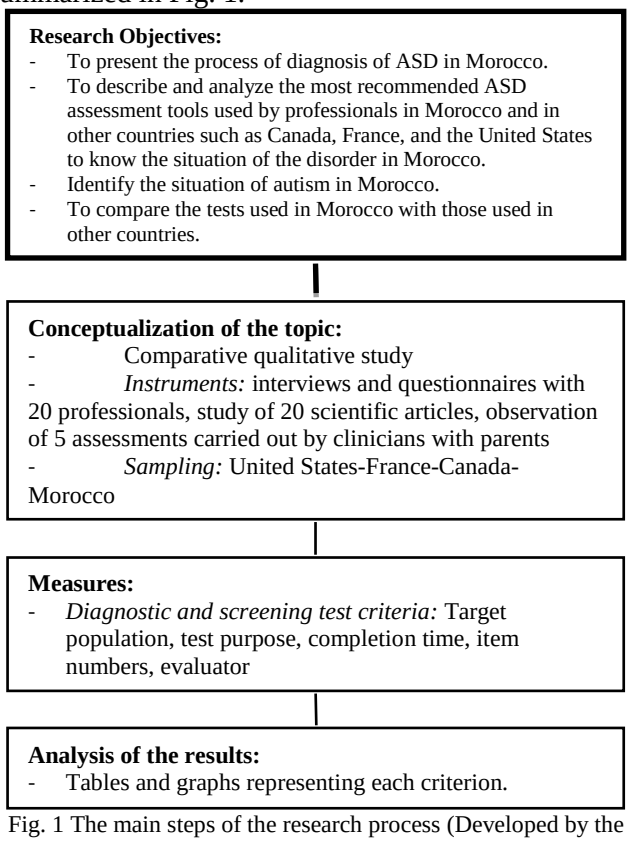

Fig. 1 The main steps of the research process (Developed by the authors)

Table 1.

Autism screening and diagnostic tools are listed in

Table 1 Autism screening and diagnostic tools (Developed by the authors)

Instrument screening	**Population affected**	**Instrument objectives**	**Number of items**	**Evaluator**
Summarized Evaluation Revised (BSE-R) [17]	Autistic disorders in a broad sense.	Tool for measuring behaviors associated with autism.	25 items and 5 degrees of severity were rated from 0 to 4.	Professionals, teachers, and parents
Modified Autism Checklist for Toddlers (M-CHAT) [18]	Screen from the age of 18 months for the first signs of behavior leading to suspicion of autism.	It allows to detect in children the risks of PDD or ASD [11]	23 items	General practitioner
Quantitative Checklist for Autism (Q- CHAT) [19]	Screen from the age of 18 months to 24 months for the first signs of behavior leading to the suspicion of autism.	It quantifies autistic traits	25 items	General practitioner
Social Communication Quiz (QCS) [20]	A mental age greater than 2 years	It targets the symptoms specific to ASD, namely communication, abnormalities and particularities in terms of social interactions and the presence of restricted, repetitive, and stereotyped behaviors.	40 items 2 versions whole life and current behavior	The parents
Autism Spectrum Screening Questionnaire (ASSQ) [21]	Children from diverse ethnic and socioeconomic Backgrounds	Identify symptoms of mild ASD in young people with normal intelligence or at the level of mild intellectual disability	27 items 3 points scale	Parents, teacher, or person who knows the child well
Autism Spectrum Quotient (QA) [22]	Normal or higher intelligence population	It makes it possible to quantify autistic traits in a population of normal or higher intelligence.	50 items *Rating in 4 points:* 5 subdomains a) social interactions, b) communication, c) attention to detail, d) alternation of attention and e) imagination.	Self-administration
Social Responsiveness Scale (SRS-2) [23]	Determine the presence of an ASD in children and adolescents aged 2 to 18 years.	Allows not only to identify the presence (or absence) of an ASD but also to understand its severity.	65 items	Parents and/or teachers
Infant-Toddler-Checklist (ITC)	Toddlers from 9 to 24 months from the general population	Assessment of gestures, eye contact, facial expressions, and vocalizations	24 items	Professionals
Pervasive Developmental Disorders Screening Test-II (PDDST-II).	Developed to identify children aged 18-48 months at risk of having ASD	It helps distinguish from those with another developmental disorder.	22 items	Professionals
Screening Tool for Autism in Toddlers & Young Children (STAT)	Children who have an older brother or sister with ASD or referred to ASD fear	It examines behaviors symptomatic of autism, in more detail.	12 items	Autism professionals [24]
Autism Diagnosis Interview – Revised (ADI-R) [25]	Children From 3 Years Old with a Development Age of at Least 24 Months.	Diagnosis/Research Diagnoses Autism and Non-Autistic PDDS as Well as Describing Worrying Behaviors as Normal Developmental Ones.	93 Items Organized in 9 Domains	Autism Professionals with Experience [26]
Autism Diagnostic Observation Schedule (ADOS-2) [27]	Children From 1 Year Old to Adults of Different Developmental Ages with Complex Language or No Language.	Autism Diagnosis/ Research. It Gives a Detailed Observation of Autistic Disorders	43 Items, Including an Overall Autism Severity Item 5 Mods: Toddler Module, 1, 2, 3 and 4	Autism Professionals with Experience.
Childhood Autistic Rating Scale (CARS) [28]	It Detects People with autism and NonAutistic Deficit Patients with Intellectual Disabilities.	Progress Monitoring It Assesses the Severity of Autistic Disorders and Associated Behaviors.	15 Categories in the Form of 15 Items.	Professionals, Teachers, Parents.
The Autistic Behavior Assessment Revised (ECA-R) [17]	Autistic Disorder and Other Pdds.	Development/Research Quantitative Evaluation of Behavioral Disorders in Young People and Detailed Measurement of the Severity of	29 Items and 5 Degrees of Severity Rated from 0 To 4.	Autism Professionals

		Autism.		
Vineland-II (VABS-II) Vineland Adaptive Behavior Scale [29]	Intellectual disability, in adulthood	*Diagnosis/evolution:* It makes it possible to identify the strong and the weak points of the adaptive behaviors of the autistic person in his daily life and to follow his evolution.	Survey version consists of 297 items Extended version consists of 577 items Classroom version consists of 244 items	Autism professionals with experience require specific training.
Psychoeducational profile (PEP-III) [30]	Development profile and educational intervention	It allows individualized psycho-educational assessment for children with autism	172 items: 3 categories: Communication and motor skills and maladaptive behaviors. 3 points rating	Autism professionals with experience
Sensory Profile (PS) [31]	Sensory processing, modulation, and behaviors Hyper and hypo-reactions	Measure the impact of children's sensory disorders on their daily life	125 items	Autism professionals
Cognitive and socio-emotional Assessment battery (BECS) [32]	People with delayed maturation were located in the developmental zone from 4 months to 24 months.	Test that assesses the cognitive and socioemotional development of children with autism or autistic children	*196 items:* 16 domains and 2 profiles: cognitive, socio-emotional	Autism professionals with experience
Aberrant Behavior Checklist (ABC) [33]	Autistic disorders in general	Evolution: It allows to appreciate the changes in the appearance or disappearance of maladaptive behaviors	*58 items:* 5 domains: sensory perception, social relations, use of objects and one's body, language, social and functional autonomy	Parents or professionals with autism experience
Communication Precursor Assessment Tool (COMVOOR) [34]	People with autism or with intellectual disabilities and communication disorders	Assess the level of presentation of people with autism with Communication disorders	Two levels with a total of five sets and 36 items	Any practitioner and worker with autism
Identification grid of the evolutionary stages of the treated autism (GREAT) [35]	Autistic disorder	Identify the evolutionary stages of autism within the framework of a psychodynamic approach.	*7 areas:* emotional and relational expressions, gaze, body image, verbal language, graphics, exploration of space and objects, time tracking, and aggression.	Professionals working with autistic patients (psychologists, psychiatrists, psychometricians, nurses, speech therapists, educators and specialized teachers) with experience

3. Results

Fig. 2 shows the time taken to complete the tests and tools for screening and diagnosis of autism. They differ according to the duration of the test and the scoring. 65% of the instruments do not exceed 60 minutes.

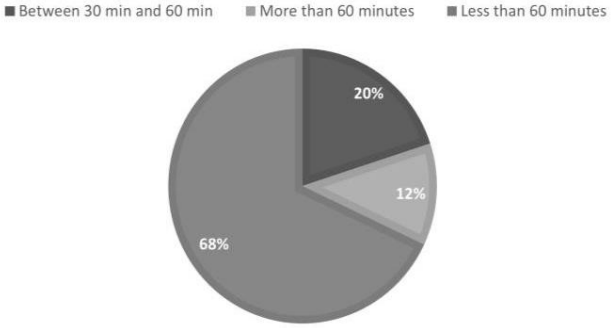

Fig. 2 Autism diagnostic tests according to the length of time (Developed by the authors)

Fig. 3 shows the tests and screening tools for autism that assess behaviors and skills according to the age of the person. 54% are for children.

Fig. 3 Screening and diagnostic tests and tools for autism according to age (Developed by the authors)

Number of tests that can be used at any age, such as the ADI-R, ADOS, CARS, Vineland scale, and SRS-2.

Fig. 4 shows the types of assessment instruments used to detect and diagnose autism.

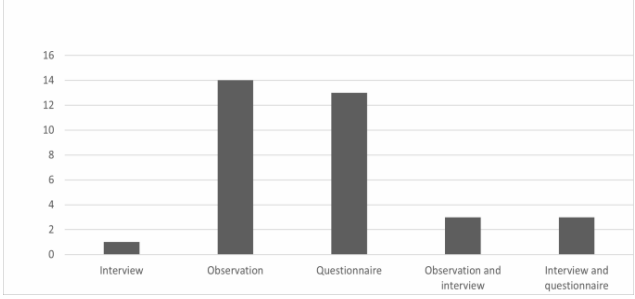

Fig. 4 Types of Autism Assessment Instruments (Developed by the authors)

Several tools are applied to detect autism, including questionnaires, interviews, and observations.

Assessment tools vary in terms of whether specific training is required.

According to our study and the tests identified, 50% of the tools require training and 50% do not require specific training (Fig. 5).

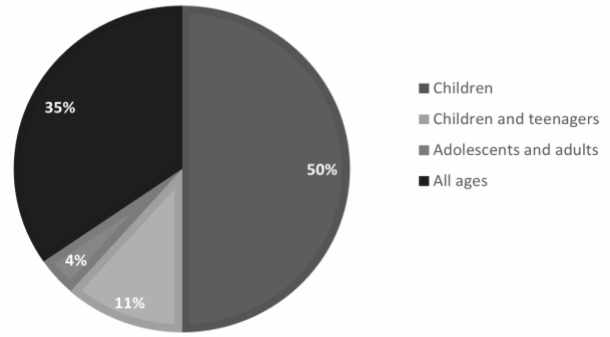

Fig. 5 The need for specific training (Developed by the authors)

4. Analysis and Discussion

The first signs of autism appear in children before they are 3 years old. Early detection and diagnosis allow better care and play an important role in the development of the child.

Autism can resemble other disorders, which can make diagnosis difficult. Pediatricians and doctors treating the child first use a series of tools to screen for autism and identify red flags, and then perform a more in-depth assessment with trained and experienced autism specialists to ask for a good diagnosis.

Our study focused on the importance and role of the most used diagnosis and identification tools. (ASD) in the world, specifically Canada, the United States, France, and Morocco.

There are several diagnostic and assessment instruments for autism; each tool offers an assessment of communication, social and behavioral skills that vary according to age and target population, the objectives of the assessment, the type of instrument (observation, interview with the parents, questionnaire filled out by a professional), the duration of the examination and rating, as well as the need or not for specific training.

Before making a diagnosis, it will be necessary to use these instruments to collect and interpret several pieces of information to have a complete picture of the person's problem.

Their misuse can lead to an incorrect diagnosis, for

This reason, the clinical approach must involve experience professionals specifically trained in autism spectrum disorders.

Through interviews with autism professionals from the three countries and Morocco specifically, we found that the tools most used to detect, diagnose, and assess autism are M-CHAT, ADIR, ADOS, and CARS.

The Modified Checklist for Autism in Toddlers (M-CHAT) is a questionnaire used to identify “red flags” and screen for autism. It is dedicated to children between 16 and 30 months. It consists of 20 items, easy to use. The results obtained by this test or by the other screening tests are insufficient.

After the screening, this child should be evaluated by a specialist experienced in diagnosing autism.

In Morocco, professionals use a tool such as the Autism Diagnostic Observation Schedule (ADOS2) is a semi- structured observation scale that allows evaluating the communication, and social interaction and thus to diagnose ASD or TED, in children, adolescents, and adults through activities and interviews adapted to all ages of daily life.

The evaluator is supposed to conduct workshops to place the person with autism in a social situation where he will have to interact. It consisted of five modules.

For a complete assessment, autism specialists organize an interview with the parents, to determine what problems the person is facing. We are using.

Autism Diagnostic Interview-Revised (ADIR) is a semi-structured interview with parents or guardians of children ages 3 and up with a developmental age of at least 18 months. It analyzes reciprocal social Interactions, communication, language, and stereotyped and repetitive behaviors.

The interview is based on 93 items organized into 9 domains, that are scored according to the desired behavior in relation to ordinary development.

The evaluator must be able to examine, during the test, whether the information required is sufficient to make the rating before moving on to the other questions.

By applying the Childhood Autistic Rating Scale (CARS) test, we can determine the degree of severity of the disorder, it is an evaluation scale dedicated to the detection of autism by distinguishing them from children with other developmental disorders and to identify the severity levels of autism based on 15 behavioral items. It includes both an interview with the family and an observation of the child's behavior.

5. Conclusion

5.1. Main Results of This Study

The diagnosis of autism is a non-strict clinical evaluation based on observation and the collection of information on the child's development and behavior from his or her family or school environment, which can be supplemented by assessments carried out by professionals experienced and trained in autism.

Clinicians do not have to apply all of these tools to make a good diagnosis, but they should choose the instruments that best meet their needs.

Diagnosis differs depending on the team, the complexity of the diagnosis, and the age of the individual.

The choice of tool depends on the objective of the assessment, the severity of pathology, the age, the type of assessment, the duration of the test, and the need for specific training.

It is necessary to train professionals on the different diagnostic and monitoring tools for autistic disorders to obtain a correct and early diagnosis.

In Morocco, the duration of the process can be very long, and autism involves several professionals from different disciplines (child psychiatrists, psychologists, rehabilitation professionals...) trained in autism. They will rely on a series of evaluations of the different dimensions of the child's development for the final validation of the diagnosis, which can only be delivered by a doctor.

Our analysis, which identifies most of the autism assessment instruments used worldwide, has allowed us to draw conclusions about the tools that can be used in each phase of the diagnostic process in Morocco.

Among the selection of tools identified, the M-CHAT, ADIR, ADOS, CARS, and M-chat.

The methods of support can be organized differently depending on the intensity of the disorder and the needs of the person with autism and the resources available.

5.2. Comparison with Other Studies

Autism spectrum disorder is a major problem and a public health priority. Numerous studies have been devoted to the instruments of screening and diagnosis of autism in their home countries, but no one occurred in Morocco.

No scientific study had been conducted regarding the situation of autism in Morocco so far.

This survey will be a first initiative of its kind to mention the main diagnostic and screening tests for autism used worldwide and in Morocco specifically.

5.3. Strengths and Limitations

Among the study strengths, this article cites the criteria of several of the most recommended autism screening and diagnostic tests used by professionals in Morocco and in other countries and presents the process of ASD diagnosis applied so far.

The lack of academic surveys and statistics and the difficulty of interviewing and reaching out to ~~all~~ the organizations and associations active in this field are limitations to the actual work.

5.4. Recommendations and Axis of Future Research

The limits of our research are a starting point for new explorations and further research. New methodologies and approaches could be put in place to improve the quality and efficiency of autism diagnosis in our country, and it is also planned to find solutions to overcome the brakes, obstacles, and difficulties in obtaining a diagnosis of autism in Morocco.

By considering the specificities of people with ASD, it is possible to design specific training for autism professionals to adapt their accompaniments to each particularity and to each specific need to support people with ASD in the best possible way.

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