ASSESSMENT OF FETAL ALCOHOL SPECTRUM DISORDERS

A TRAINING WORKBOOK

PAHO
Pan American Health Organization
World Health Organization
REGIONAL OFFICE FOR THE Americas

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Preface

Fetal alcohol spectrum disorders (FASD) represent a range of physical, mental, and behavioral disabilities caused by alcohol use during pregnancy, or prenatal alcohol exposure (PAE). FASDs are considered to be one of the leading preventable causes of developmental disability, with an estimated 119,000 children being born with FAS each year in the world (Popova et al. 2017).[1] Despite its high prevalence, FASD is often misdiagnosed or underdiagnosed, making intervention more challenging. A multidisciplinary team of providers who understand the diagnostic requirements is crucial for an accurate FASD diagnosis.

Since the 1700s, the physical and behavioral characteristics of children exposed to alcohol prenatally have been reported. In 1972, Jones and Smith coined the term fetal alcohol syndrome to describe these findings in children born to alcoholic mothers.[2] In 1996, the Institute of Medicine distinguished four different disorders resulting from PAE: fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (PFAS), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD).[3] Since then, the diagnostic criteria have been revised multiple times, with different versions in use around the world (Canadian Guidelines, CDC, etc.).[4,5,6] The diagnostic criteria presented in this booklet are based on the Updated Clinical Guidelines for Fetal Alcohol Spectrum Disorders, developed in the United States, with the exception that 10 grams of alcohol is used instead of 14 grams as a standard drink equivalent per WHO guidelines and the use of WHO growth charts for all ages instead of CDC growth charts for children over 2 years.[7] Further work is currently being done to come to a consensus on international standards for FASD diagnosis, and each country should adjust their criteria according to their population and experience.

The information provided in this booklet was initially developed for use in Spanish-speaking countries of the Americas and is intended to serve as a training workbook for providers of various disciplines to learn about the fundamentals of diagnosing FASD and to apply them to several case scenarios. Target audiences include physicians, psychologists, allied health professionals, social workers, and other providers that may encounter individuals affected by FASD. It is ideally used as a supplement for in-person training by experts in the fields of dysmorphology, epidemiology, and neuropsychology.

Acknowledgments

This workbook was drafted and finalized by Diego Gomez (Creighton University), Christie Petrenko (University of Rochester), Maristela Monteiro (PAHO), and Omar Rahman (University of Nebraska Medical Center). The content draws upon their previous experience conducting trainings on fetal alcohol spectrum disorders (FASD) diagnosis and intervention in Chile and the Dominican Republic. Therefore, it should be noted that the neuropsychologic assessments suggested were selected because of their availability in Spanish. This work was supported by the Pan American Health Organization. We thank Dr. Gene Hoyme (University of South Dakota) for providing the updated guidelines on FASD diagnosis. We also thank Tom Waples, Rosalia Alexis, and Nicole Hackendahl for graphic design support on this project.

The materials presented in this document were reviewed by Dr. Pablo Duran, Dr. Betzabe Butron Riveros, Dr. Vladimir Poznyak, Carla Saenz, Marcie Neal, and Florencia Luna, and their feedback was essential in creating the final version.

Acronyms and abbreviations

ARBD: alcohol-related birth defects
ARND: alcohol-related neurodevelopmental disorder
CDC: Centers for Disease Control and Prevention
CNS: central nervous system
FAS: fetal alcohol syndrome
FASD: fetal alcohol spectrum disorders
Ht: height
IQ: intelligence quotient
OFC: occipital frontal circumference
PAE: prenatal alcohol exposure
PAHO: Pan American Health Organization
PFAS: partial fetal alcohol syndrome
Sc: scaled score
SDE: standard drink equivalent
SS: standard score
T: T score
WHO: World Health Organization
Wt: weight

FASD diagnosis

Fetal alcohol spectrum disorders (FASD) represent a continuum of characteristics found in individuals who have been prenatally exposed to alcohol.

The spectrum is comprised of four defined diagnostic categories: fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (PFAS), alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD).

There are **five characteristics** that are assessed in an FASD evaluation. The specific FASD diagnostic categories differ according to the characteristics that are present.

1. **Alcohol exposure.** Information about prenatal alcohol exposure should be obtained from the biological mother or other reliable collateral sources (e.g., family member, social service agency, medical record). FAS and PFAS can be diagnosed without confirmation of prenatal alcohol exposure if sufficient characteristics are present.

2. **Facial features.** This is defined as the presence of at least two of the three cardinal facial features: short palpebral fissures (≤10th percentile), smooth philtrum, and thin vermilion border of the upper lip (the latter two being ranked 4 or 5 on a racially normed lip/philtrum guide, as seen in Figure 4).[8, 9, 10]

3. **Growth anomalies.** These are defined as low height and/or weight (≤10th percentile). Population-specific growth curves should be used for comparison. If unavailable, WHO growth charts are recommended for all children.[11, 12]

4. **Central nervous system (CNS) anomalies.** These are defined as one or more of the following: small head circumference (≤10th percentile), structural brain anomalies, or recurrent nonfebrile seizures.[13]

5. **Neurobehavioral impairment.** The amount of evidence needed for the neurobehavioral impairment criterion differs for FAS and PFAS versus ARND. For children under 3, criteria for FAS or PFAS can be met if developmental delays are greater than 1.5 standard deviations below average. ARND cannot be diagnosed until 3 years of age. See pages 21-22 for full descriptions and guide.

The characteristics seen in FASD are not unique, as these are individually present in a variety of other genetic, teratogenic, and neurodevelopmental conditions (such as autism spectrum disorder or intellectual disability). However, the pattern of characteristics seen in alcohol exposure is specific to FASD. Therefore, **FASD is a diagnosis of exclusion**, having first ruled out any other condition that would better explain the features seen in an individual. Additional features of the face, joints, and hands are seen in FASD and can be helpful as supportive evidence for a diagnosis. However, consultation with a clinical geneticist or the use of genetic testing may be necessary in complex cases that do not clearly fit with an FASD diagnosis.

The level of the exposure including dose and timing during pregnancy, nutritional status and genetic factors affecting the metabolism of alcohol can result in different phenotypes within the FASD continuum. Higher levels of alcohol intake early in pregnancy (such as heavy drinking, defined as when a person drinks more than 60 grams of pure alcohol in a single occasion) increase the risk for facial anomalies and birth defects. Repeated low-level alcohol exposure (drinking regularly during pregnancy in lower amounts, below 60 grams in any occasion, for example) can also result in an FASD phenotype, and exposure later in pregnancy is more likely to affect growth and CNS development.

FASD can present at any age. Newborns and infants may present for evaluation due to known prenatal alcohol exposure. Some young children may be referred for evaluation due to facial dysmorphology and/or growth deficiency. School-age children may present due to learning issues or behavioral problems at home or in the classroom, particularly if physical features are absent. Occasionally, individuals will not be suspected until adolescence due to behavioral problems or other evidence of disruption in higher executive function. Early childhood (3-10 years) is the ideal age for FASD assessment. Facial features are indistinct in newborns and infants and tend to fade during late adolescence. In addition, children within this age range can complete neuropsychological tests across multiple domains of functioning to aid in rendering a diagnosis and intervention planning.

The tools required for a diagnosis of FASD are a ruler, a tape measure, a scale, a racially-normed lip/philtrum guide (Figure 4), appropriate growth charts (Figures 5-18), and a neuropsychological evaluation.

DIAGNOSTIC CRITERIA (Figure 1):

I. **Fetal alcohol syndrome (FAS)** requires the first four characteristics of the spectrum, regardless of confirmed maternal alcohol use: facial features, growth anomalies, CNS anomalies, and neurobehavioral impairment. Neurobehavioral impairment can be met with a deficit defined as 1.5 SD below the mean in any of the following:

   a. Cognition (for children ≥ 3 years of age) which may be:

      1. Global (general conceptual ability, or performance IQ, or spatial IQ) OR

      2. One neurobehavioral domain (executive functioning, specific learning impairment, memory impairment, or visual-spatial impairment).

   b. Behavior with normal cognition in at least one domain for children ≥ 3 years of age (mood or behavioral regulation impairment, attention deficit, or impulse control).

   c. Developmental delay (for children < 3 years of age).

II. **Partial fetal alcohol syndrome (PFAS)** diagnosis varies depending on whether alcohol exposure has been confirmed or not.

   a. If alcohol exposure is confirmed, only two criteria are required: facial features and neurobehavioral impairment (as defined above for FAS).

   b. If alcohol exposure is not confirmed, three criteria are required: facial features, neurobehavioral impairment (as defined above for FAS), and growth anomalies OR CNS anomalies.

III. **Alcohol-related neurodevelopmental disorder (ARND)** requires confirmation of prenatal alcohol exposure and neurobehavioral impairment. Neurobehavioral impairment can be met with deficits defined as 1.5 SD below the mean in any of the following:

   a. Cognition (for children ≥ 3 years of age) which may be:

      1. Global (general conceptual ability, or performance IQ, or spatial IQ) OR

      2. Two neurobehavioral domains (executive functioning, specific learning impairment, memory impairment, or visual-spatial impairment).

   b. Behavior with normal cognition in at least two domains for children ≥ 3 years of age (mood or behavioral regulation impairment, attention deficit, or impulse control).

   Note: Children under the age of 3 cannot be adequately assessed for ARND since a comprehensive neurobehavioral assessment is required. Developmental delay alone is not sufficient to make this diagnosis as it is common, non-specific, and may be temporary. Exposed children should be monitored and re-evaluated after the age of 3 years to determine if they are affected.

IV. **Alcohol-related birth defects (ARBD)** requires confirmation of prenatal alcohol exposure and one or more major malformations (e.g., defects of cardiac, skeletal, renal, eye, and ear systems) that have been previously associated with alcohol exposure. No criteria in the neuropsychological assessment need to be met. The malformations seen in this diagnosis are related to the timing of exposure coinciding with critical periods of embryogenesis. A comprehensive list of associated malformations can be found in the Hoyme (2016) article.

Figure 1. FASD Diagnostic Criteria Chart

This chart is a simplified visual aid that graphically demonstrates the FASD diagnostic criteria.

FETAL ALCOHOL SPECTRUM DISORDERS (FASD) DIAGNOSTIC CRITERIA

Abnormal neuropsychology	Facial features	Low height and/or weight	CNS anomalies	Major malformation	
WITH DOCUMENTED ALCOHOL EXPOSURE					
+	+	+	+	-	FAS
+	+	-	-	-	PFAS
+ *	-	-	-	-	ARND
-	-	-	-	+	ARBD
WITHOUT DOCUMENTED ALCOHOL EXPOSURE					
+	+	+	+	-	FAS
+	+	+ ← **or** →	+	-	PFAS

* Abnormal neuropsychology in ARND cannot be adequately assessed in individuals under 3 years of age.

Prenatal alcohol exposure

Assessing prenatal alcohol exposure (PAE) is important to the FASD diagnosis as the diagnostic process is highly dependent on the confirmation of documented alcohol exposure. This section covers the definition of prenatal alcohol exposure and a standard drink equivalent along with the methodology used to calculate standard drink equivalents. Two methods are included for assessing this, the AUDIT and the AUDIT-C.

Definition of prenatal alcohol exposure

Prenatal alcohol exposure defined by the criteria are met with any one of the following:

- Six or more standard drinks per week for two or more weeks
- Three or more standard drinks per occasion on two or more occasions
- Documentation of alcohol-related social or legal problems in proximity to the pregnancy (including the three-month period prior to recognition of the pregnancy) such as:
  - History of driving while intoxicated
  - Treatment of an alcohol-related condition
  - Documentation of intoxication during pregnancy by blood, breath, or urine alcohol testing
- Positive testing with established alcohol-exposure biomarker in maternal hair, fingernails, urine, blood, placenta, or meconium such as:
  - Fatty acid ethyl esters
  - Phosphatidylethanol
  - Ethyl glucuronide
- Increased prenatal risk associated with drinking during pregnancy assessed by a validated screening tool such as:
  - AUDIT (Alcohol Use Disorders Identification Test): designed to screen for overall alcohol dependence with scores of 20 or above requiring further diagnostic evaluation
  - AUDIT-C: abbreviated version of the AUDIT focusing on the first three questions regarding consumption with a score of 5 or more indicating an increased risk for FASD
  - T-ACE: four question screening tool with a score of 2 or more indicating potential prenatal risk
  - Timeline Followback Method (TLFB)
    - Source: Sobell LC, Sobell M (1996): Timeline Followback Method (Drugs, Cigarettes, and Marijuana)

Definition of a standard drink

A standard drink, as defined by the World Health Organization (WHO), is a drink with approximately 10 grams of pure alcohol. Note that the Hoyme (2016) guidelines utilize 14 grams of pure ethanol to define a standard drink equivalent. However, this booklet will defer to the WHO recommendation in order to enhance identification of cases at risk.

It is important to note the type of alcoholic beverage consumed, as the amount of pure alcohol in a drink depends on its alcohol content and its volume. The amount of liquid in an alcoholic drink, glass, can, or bottle is not necessarily equivalent to the amount of alcohol (or ethanol) it contains. Different types of beer, wine, or malt liquor can have varying amounts of alcohol content. For example, regular beers have about 5% alcohol content by volume, ciders have about 5.5%, wines have about 12%, fortified wines about 20%, and spirits (whisky, vodka, rum) have about 40% alcohol content. Therefore, one standard drink, measured in volume or weight, allows for a comparison between beverages and totaling the alcohol consumed when various types of alcohol are taken. Figure 2 uses the definition of one standard drink as 10 grams of alcohol to present various beverages with their corresponding equivalent in number of standard drinks. For example, one can of beer will have 1.3 standard drinks, while one 750-mL bottle of wine will have 7 standard drinks, and one 750-mL bottle of whisky will have 24 standard drinks. A person drinking two cans of beer, one glass of "restaurant pour" wine, and one glass of fortified wine in a meal, will have consumed 5.3 standard drinks. The volume of pure alcohol can be converted into grams of pure alcohol by multiplying the amount of alcohol in milliliters (mL) by 0.79, the specific density of alcohol (Figure 3).

Figure 2. Standard drink approximations

Calculating a standard drink equivalent

In order to calculate a standard drink equivalent, two variables must be known: the alcohol percentage of a beverage, and its volume. The formula in Figure 3 can be used to calculate a standard drink equivalent using these two variables.

Figure 3. Standard drink equivalent calculation

Standard Drink Equivalent

$$S.D.E. = \frac{\text{Volume of beverage consumed (mL)} \times \frac{\text{\% alcohol by volume}}{100\%} \times 0.79 \text{ grams pure alcohol/mL}}{10 \text{ grams}}$$

For example, a 100 mL glass of wine with 12% alcohol by volume:

$$\frac{100 \text{ mL} \times \frac{12\% \text{ alcohol by volume}}{100\%} \times 0.79 \text{ grams pure alcohol/mL}}{10 \text{ grams}}$$

= 0.95 standard drinks ≈ 1 standard drink

AUDIT/AUDIT-C

The Alcohol Use Disorders Identification Test (AUDIT) is a screening method developed by the WHO to identify excessive drinking patterns or alcohol use disorders in a cross-national population.[14] The test is comprised of ten questions. The first three questions assess alcohol consumption, questions 4-6 refer to specific behaviors related to alcohol dependence, and the last four questions inquire about consequences or problems related to alcohol consumption. The test can be administered as an oral interview or as a self-report questionnaire. The patient must respond to the first eight questions by assigning a score of 0-4, and a score of 0, 2, or 4 for the last two questions.

AUDIT: Self-Report Version

PATIENT: Because alcohol use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of alcohol. Your answers will remain confidential so please be honest. Place an X in one box that best describes your answer to each question.

Questions	0	1	2	3	4	Score
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week	
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more	
3. How often do you have six or more drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4. How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5. How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
9. Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year	
					Total	

There have been multiple scoring systems developed for the AUDIT dependent on the population being screened and the goals of the screening program. It has been noted that scores above 7 are indicative of harmful levels of alcohol use and possible dependence. Scores of 10 or greater may reduce the false negative rate, but may cause a reduction in the identification of at-risk individuals. Any program seeking to use the AUDIT should develop a scoring system that is relevant and applicable for the population being targeted.

A modified version of the AUDIT, the AUDIT-C, has been developed in order to screen for prenatal alcohol exposure. The AUDIT-C is comprised of the first three questions in the AUDIT and is meant to assess drinking patterns during pregnancy and three months prior to the recognition of the pregnancy.

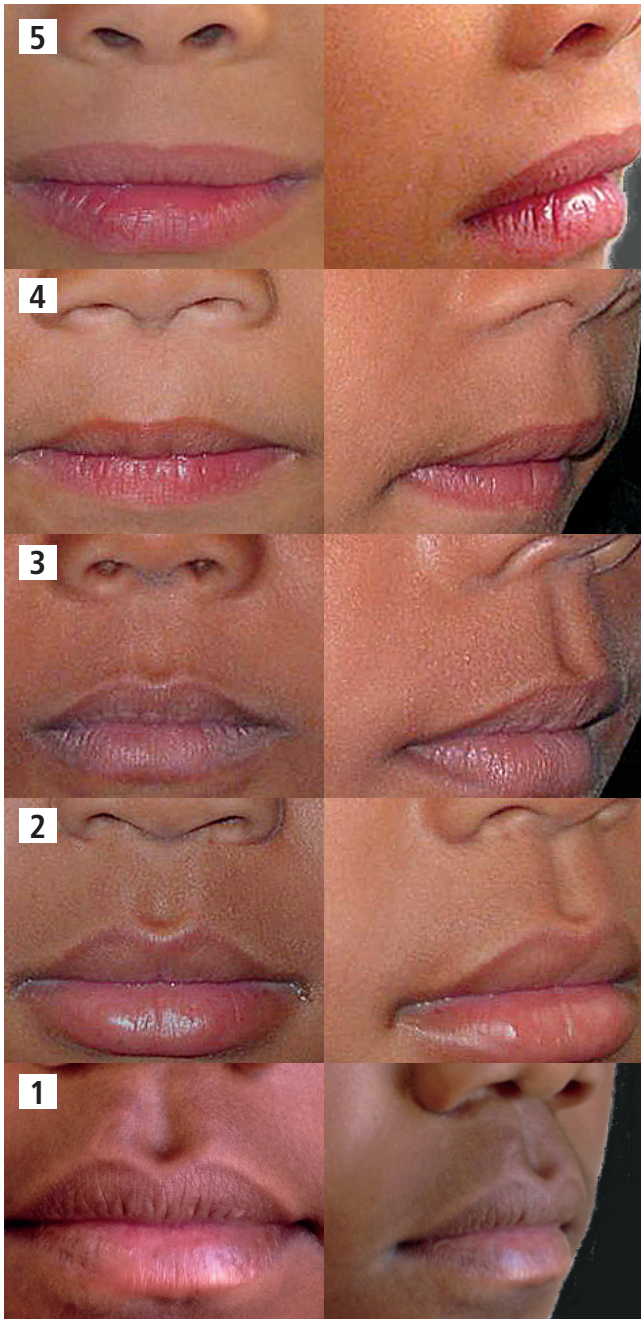
Questions	0	1	2	3	4	Score
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week	
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more	
3. How often do you have six or more drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
					Total	

To score the AUDIT-C, each individual score for each question must be added to obtain a total score.

- A total score of 0 indicates no prenatal alcohol exposure
- A total score of 1-4 confirms prenatal alcohol exposure
- A total score of 5 confirms prenatal alcohol exposure, with high risk for FASD

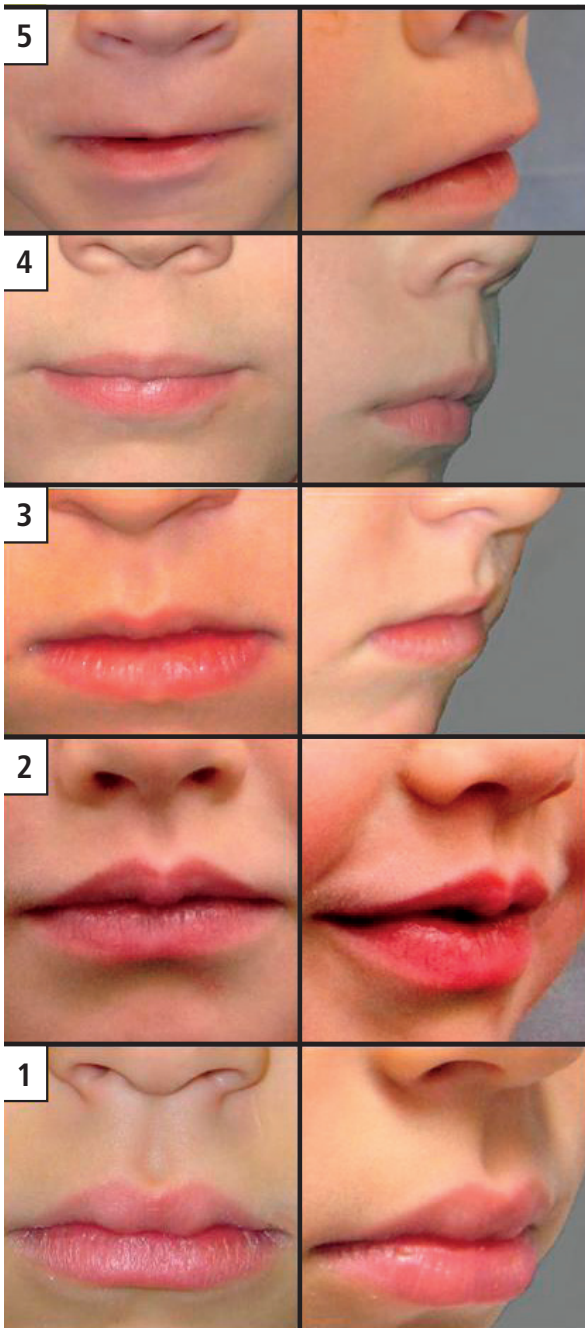
Figure 4. Lip/philtrum guides

South African Mixed Race Lip/Philtrum Scale



Hoyme, HE, Hoyme, DB, Elliott, AJ, et al. 2015. A South African mixed race lip/philtrum guide for diagnosis of fetal alcohol spectrum disorders. Am J Med Genet Part A. 167A:752-5. Reproduced with permission from John Wiley and Sons.

Caucasian
Philtrum/Vermilion Scale



Lip/philtrum guide for the white population, incorporating a 45-degree view. This guide was produced by analysis of photographs of >800 white children from school-based studies in the United States. Scores are assessed separately for the philtrum and vermilion border, scores of 4 or 5 are compatible with FAS or PFAS. Reproduced with permission from the Journal of Pediatrics, Vol. 138, Page 8, Copyright © 2016 by the AAP.

Palpebral fissure length

The palpebral fissure length is typically determined using a ruler to measure the distance between the inner canthi (where the eyelids meet interiorly) and the outer canthi (where the eyelids meet laterally). The ruler should be brought as close as possible to the eye without touching the eyelashes as shown in image A, and the examiner should be seated at the same level as the subject to avoid parallax error. The ruler should follow the natural slant of the eye and the subject should be asked to look up in order to make both inner and outer canthi visible as shown in image B. Image C explains why using a photographic image decreases the accuracy of the measurement, as the measurement obtained is “A”, while the correct measurement is “C.” A percentile graph for palpebral fissure length is provided in Figure 5 and measurements that fall at or below the 10th percentile are considered short.

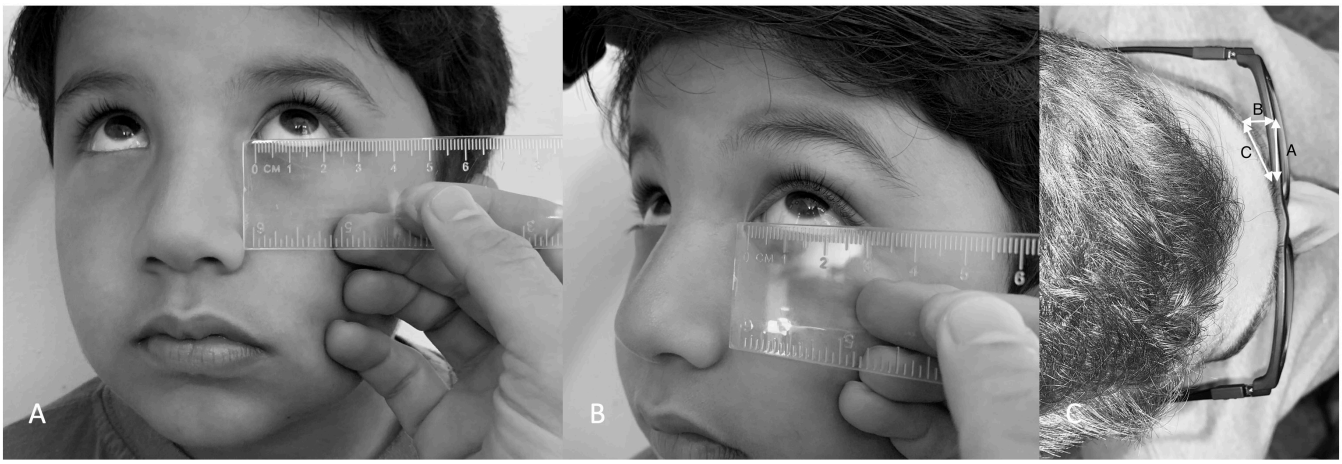
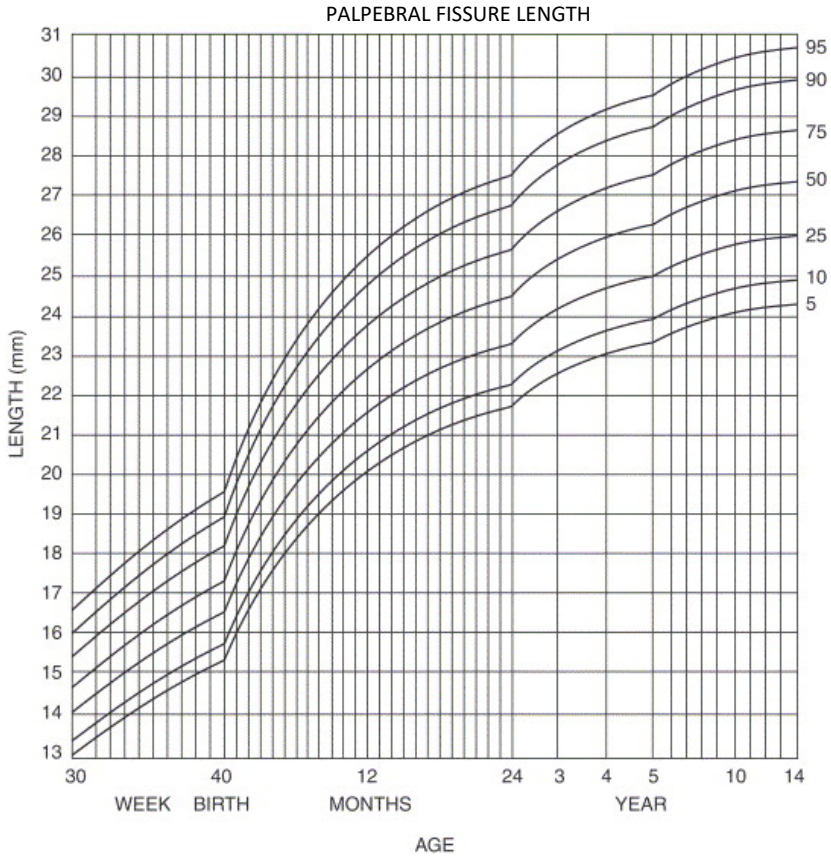


Figure 5. Palpebral fissure length



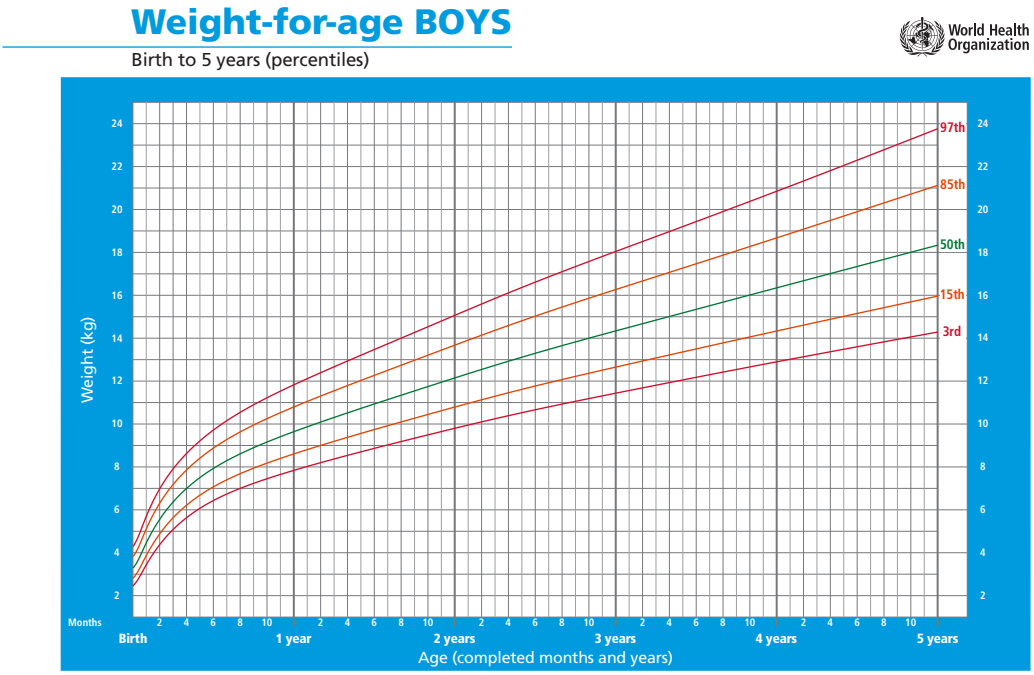
Source: Thomas IT, Gaitantzis YA, Frias JL. Palpebral fissure length from 29 weeks gestation to 14 years. J Pediatr. 1987 Aug;111(2):267-8. Permission to reprint was granted by the Canadian Copyright Licensing Agency.

Growth curves

Population-specific growth charts should be used in order to determine the weight and height percentile of an individual. If unavailable, WHO growth charts are recommended and are provided below for most instances. Due to the absence of a weight-for-age growth chart for children over the age of 10 years, CDC growth charts are provided for this population. When birth weight or birth length are being assessed in premature infants, it is recommended to use the International Fetal and Newborn Growth Consortium for the 21st Century (Intergrowth-21st) charts available at https://intergrowth21.tghn.org/

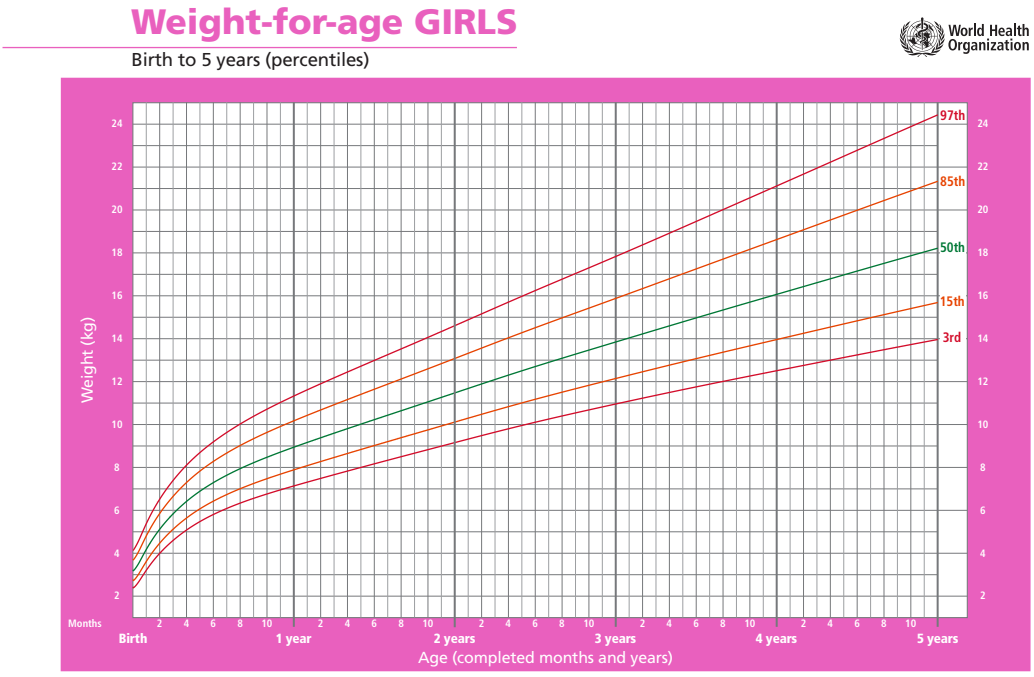
Weight

Figure 6. Weight for boys ages 0–5 years



WHO Child Growth Standards

Figure 7. Weight for girls ages 0–5 years



WHO Child Growth Standards

Figure 8. Weight for boys ages 5–10 years

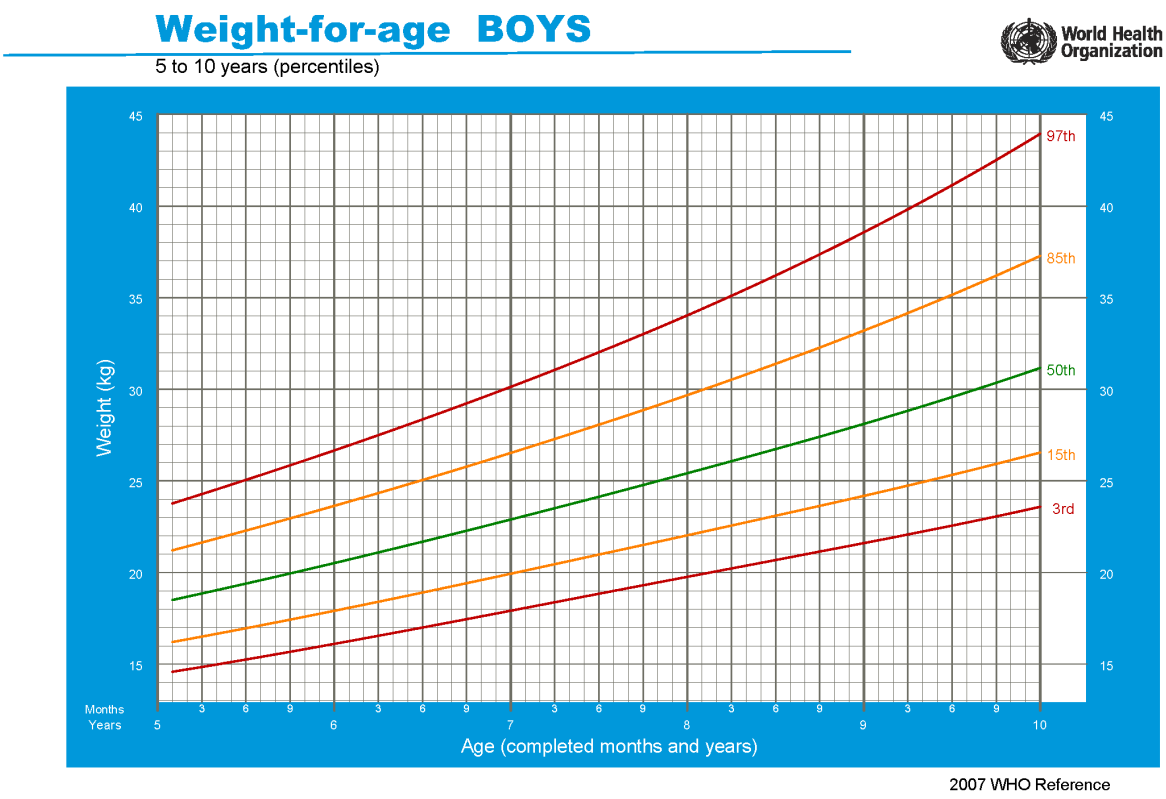
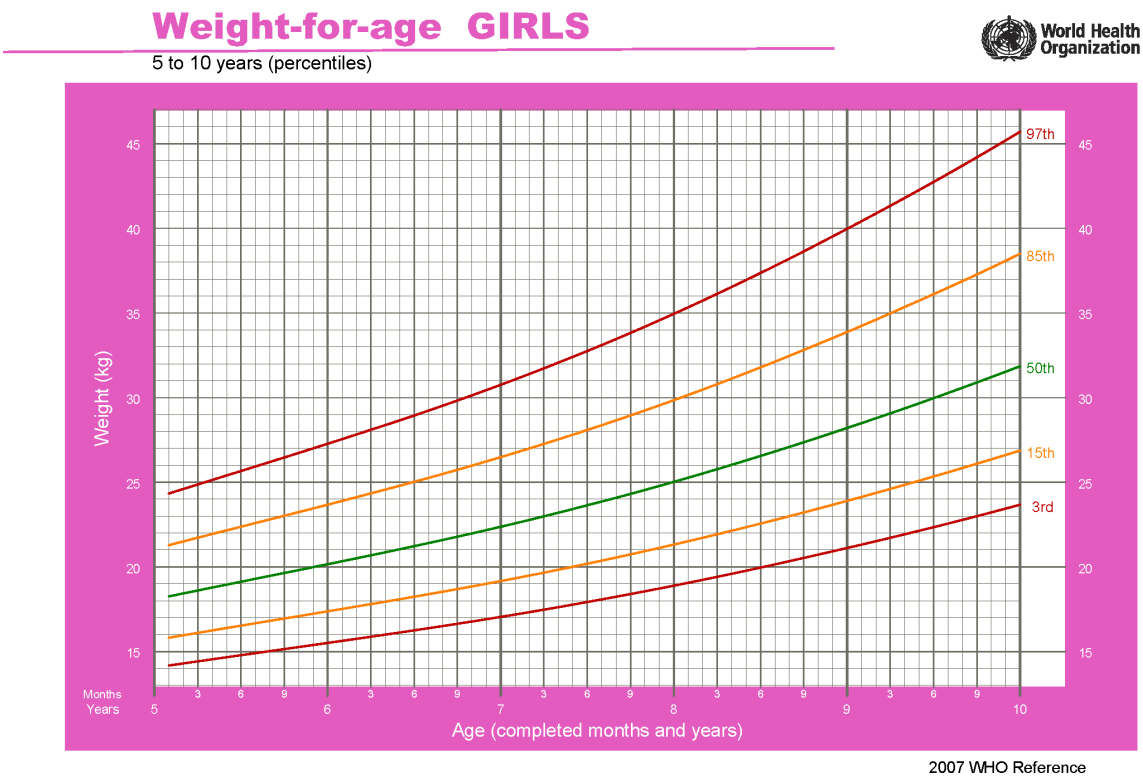
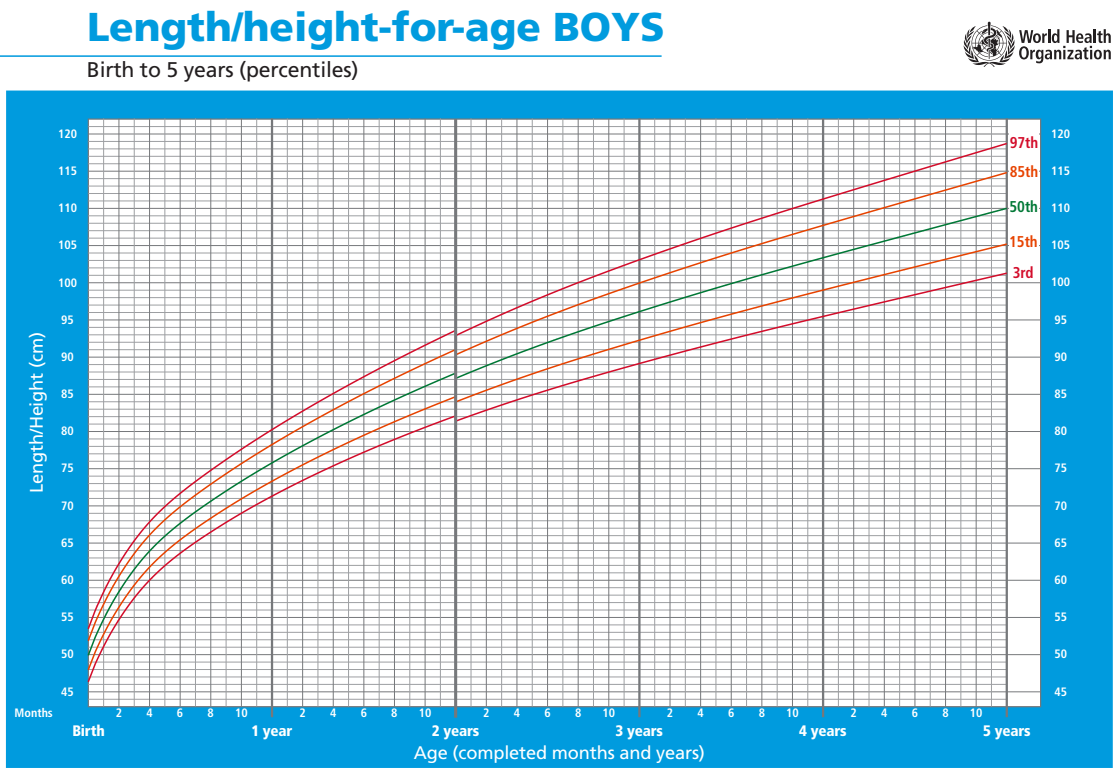


Figure 9. Weight for girls ages 5–10 years



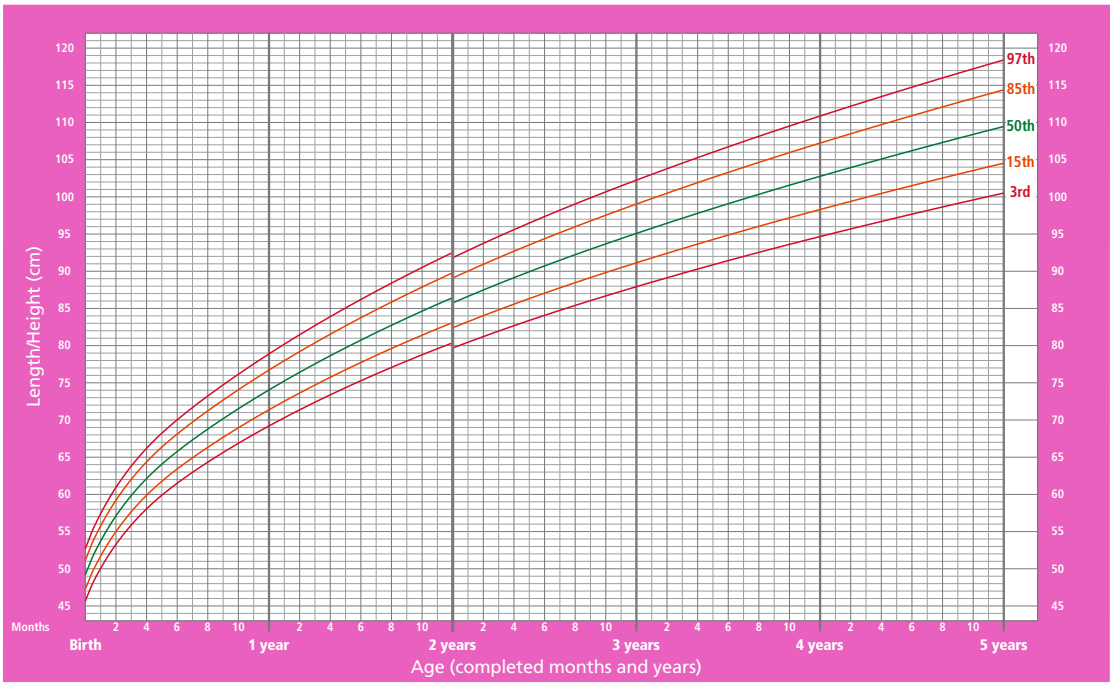
Length

Figure 10. Length for boys ages 0–5 years



WHO Child Growth Standards

Figure 11. Length for girls ages 0–5 years



WHO Child Growth Standards

Figure 12. Height for boys ages 5–19 years

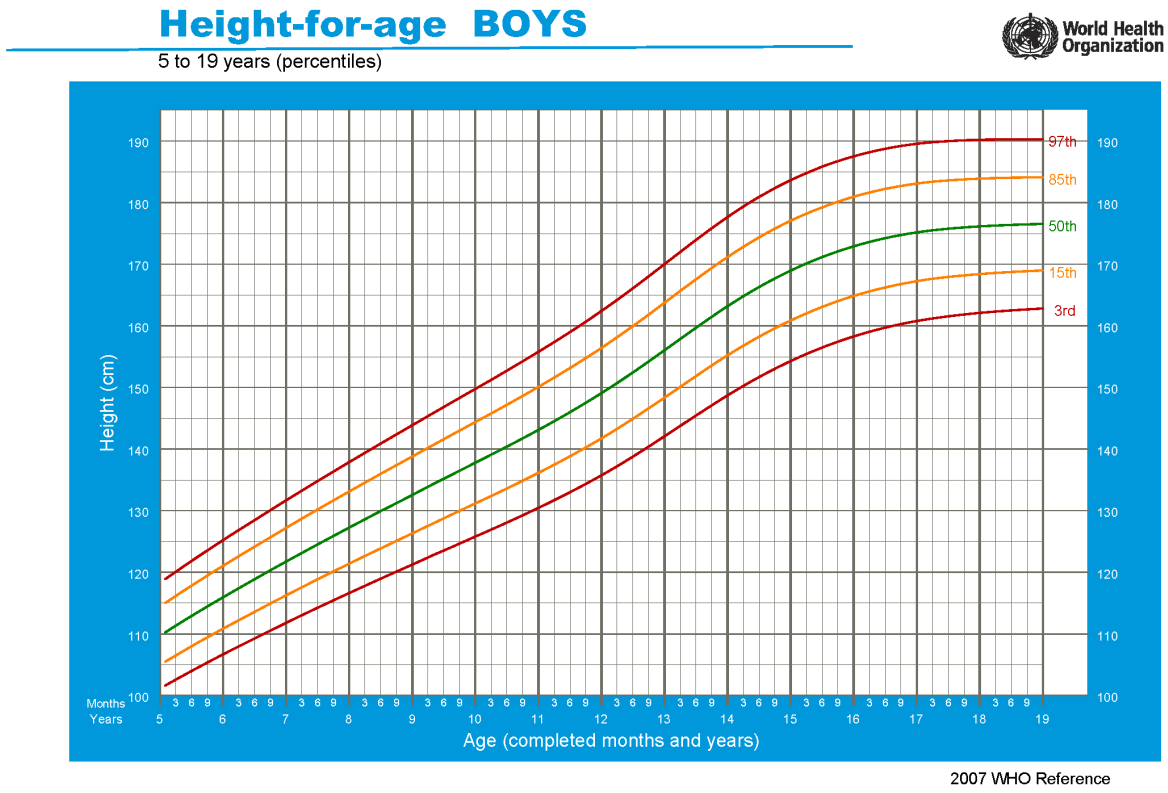
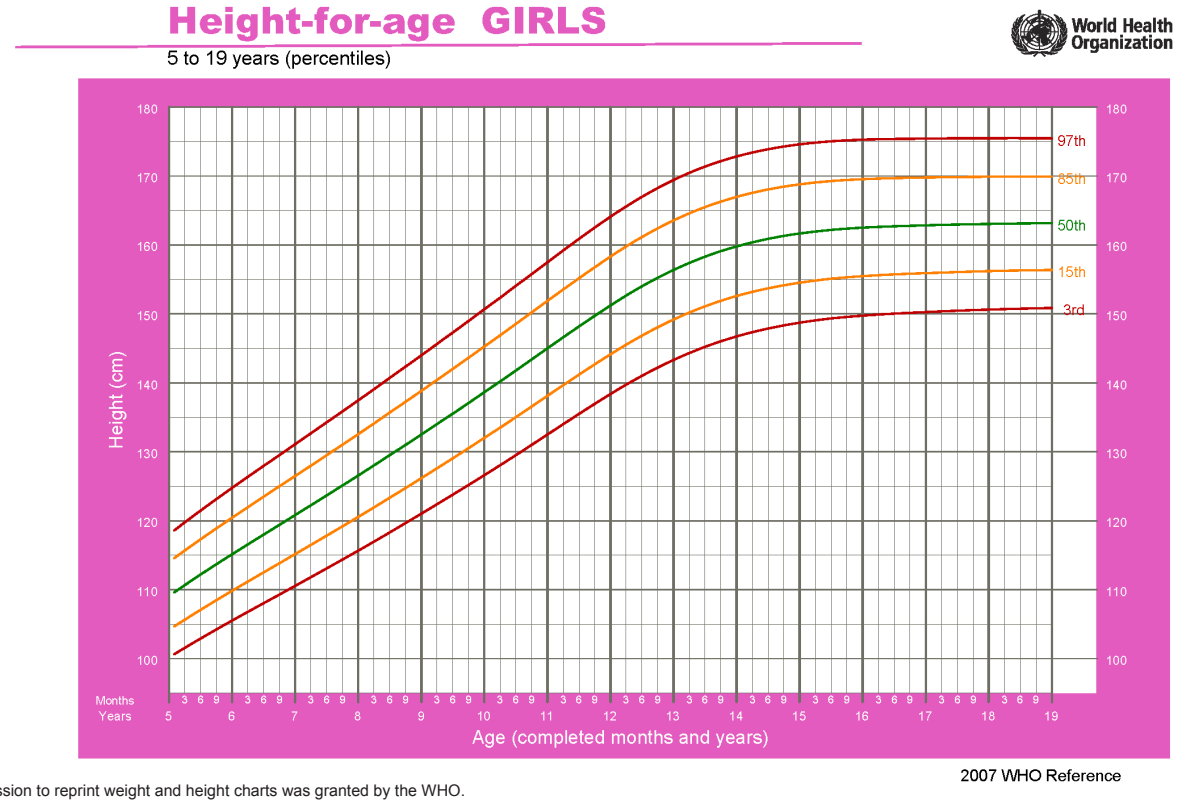
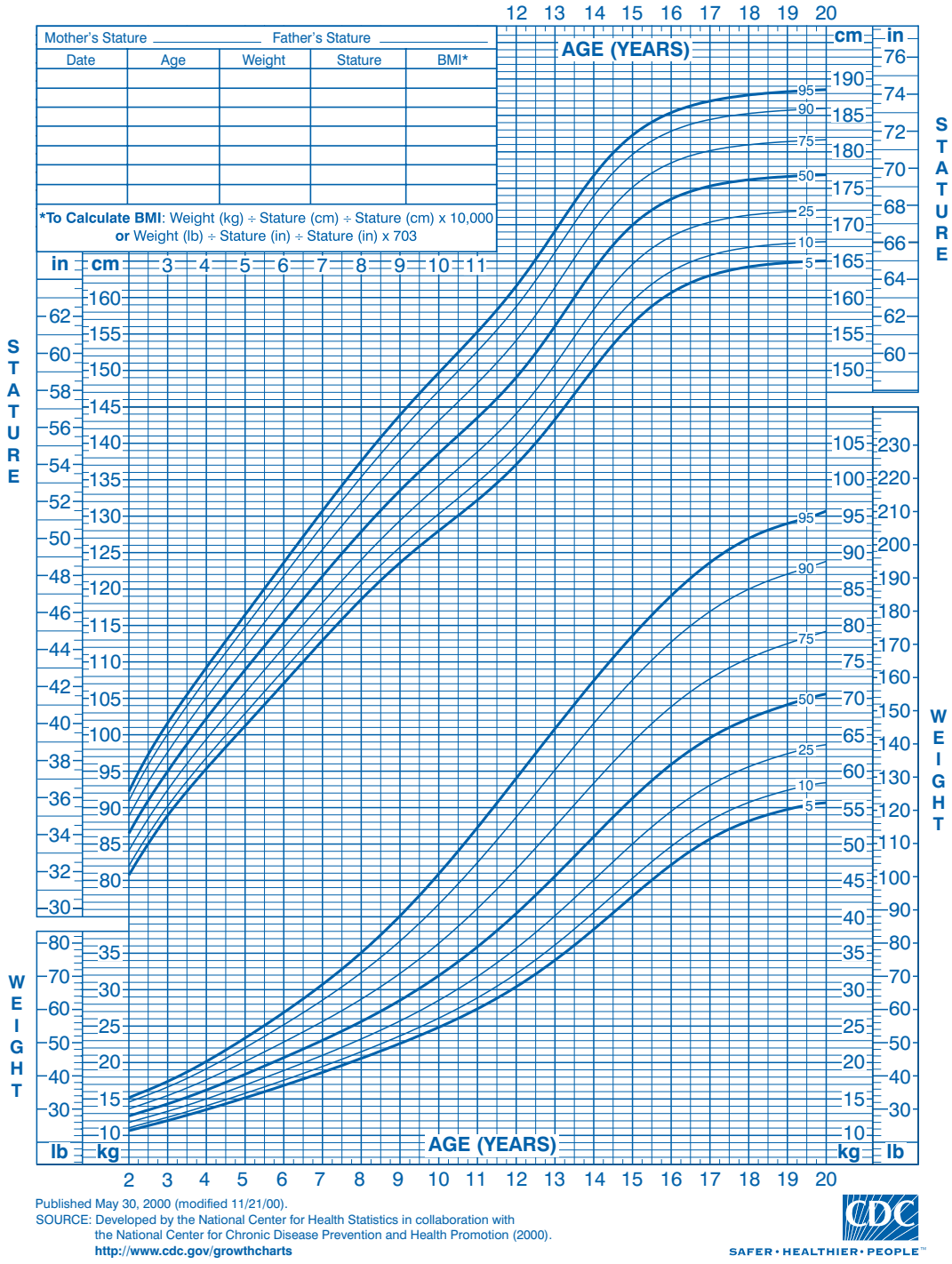


Figure 13. Height for girls ages 5–19 years



Weight and height

Figure 14. Weight and height for boys ages 2–20 years



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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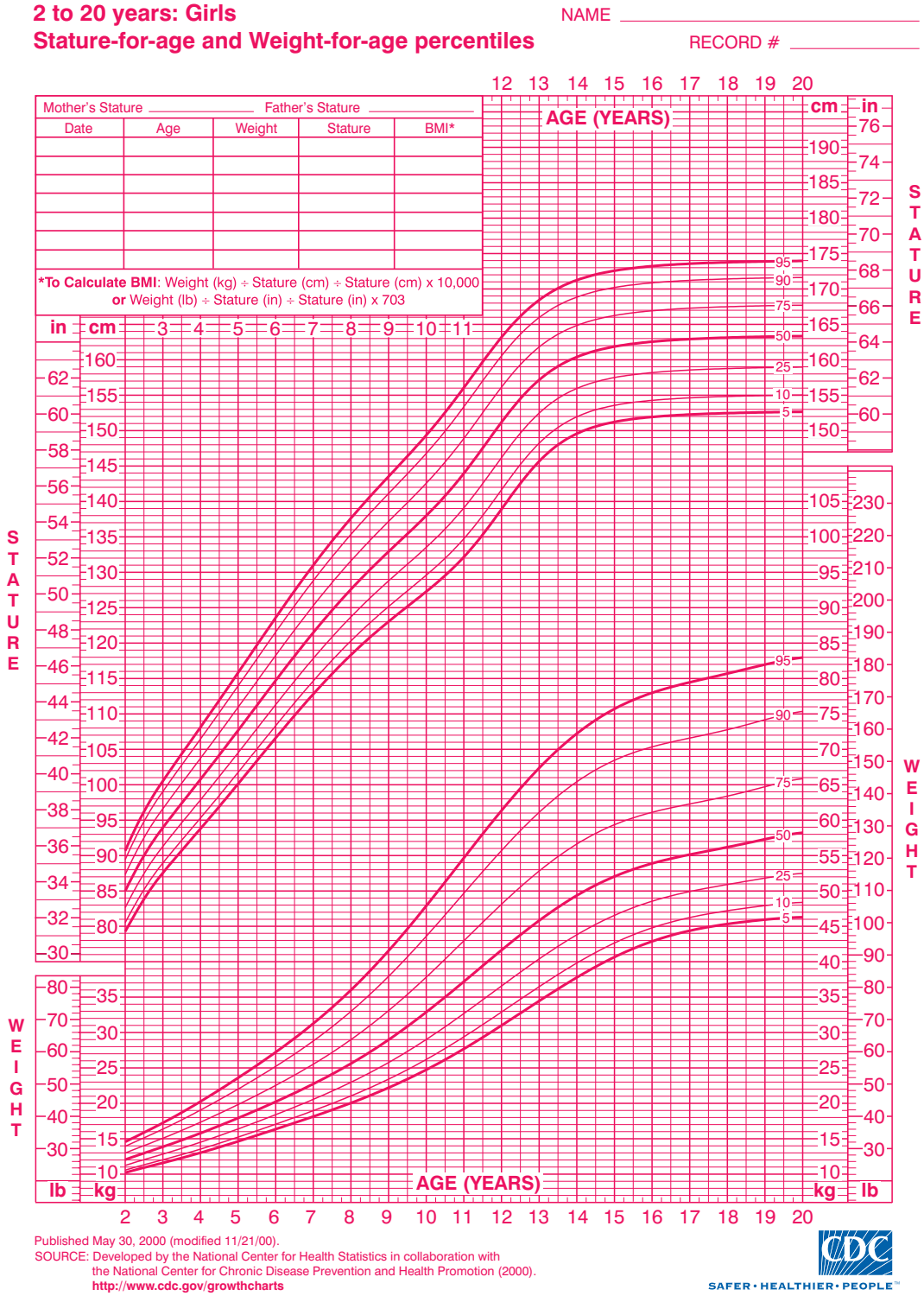
Figure 15. Weight and height for girls ages 2–20 years



Head circumference

To measure the head circumference of a child, a measuring tape that cannot be stretched must be used. Place the tape around the widest possible circumference of the head, which is on the broadest part of the forehead above the eyebrows, above the ears, and on the most prominent part of the back of the head (CDC). Population-specific head circumference charts should be used in order to determine the head circumference percentile of an individual. If unavailable, WHO growth charts are recommended and are provided below for most instances. Due to the absence of a head circumference-for-age growth chart for individuals over the age of 5 years, additional head circumference charts are provided for this population (Rollins, Collins, and Holden, 2010).[13]

Figure 16. Head circumference for boys 0–5 years

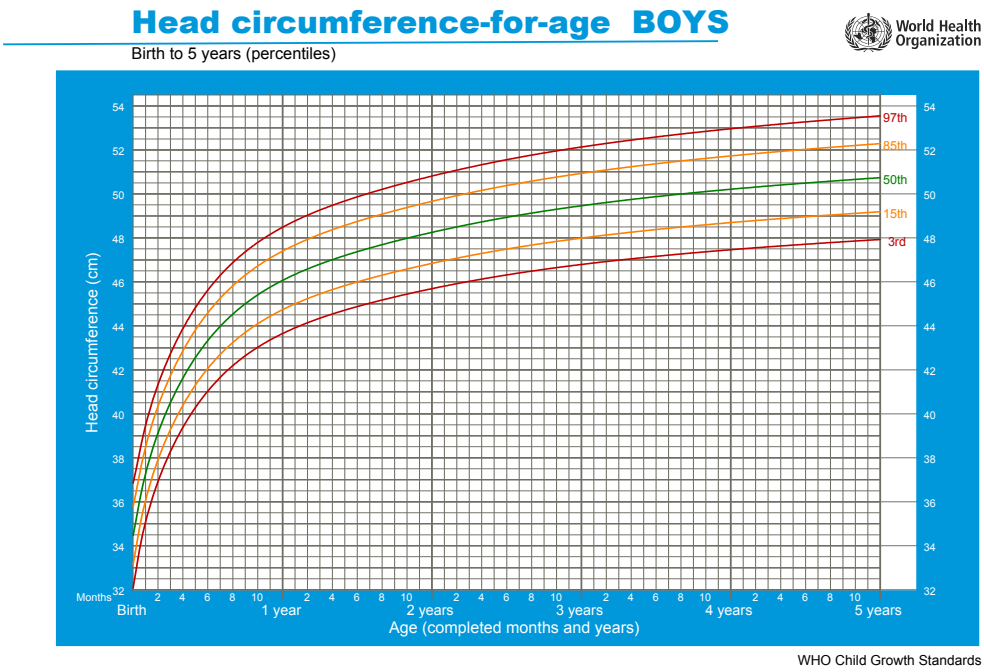
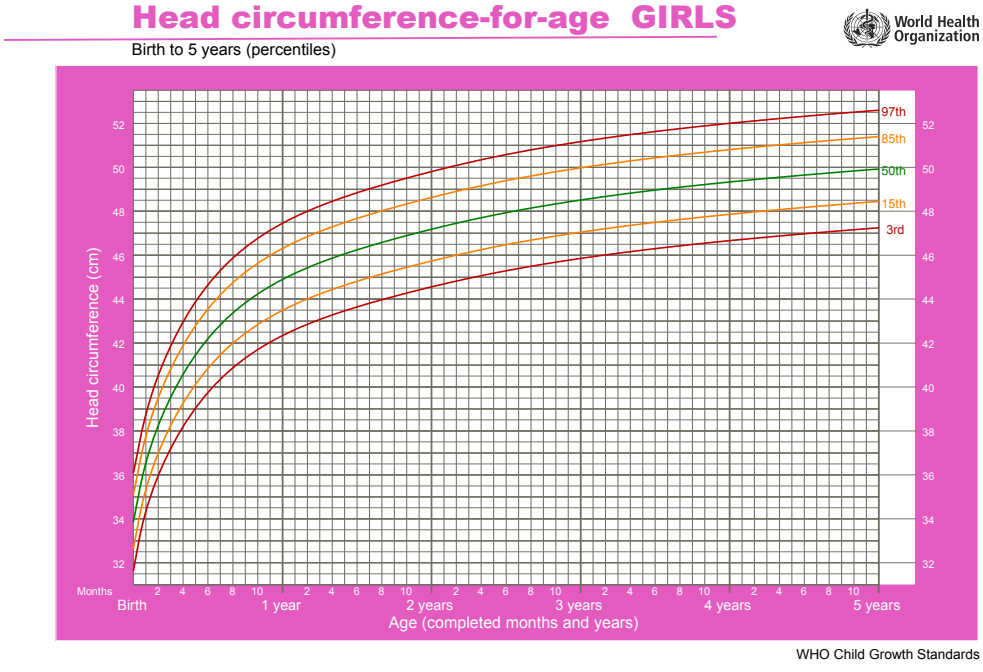
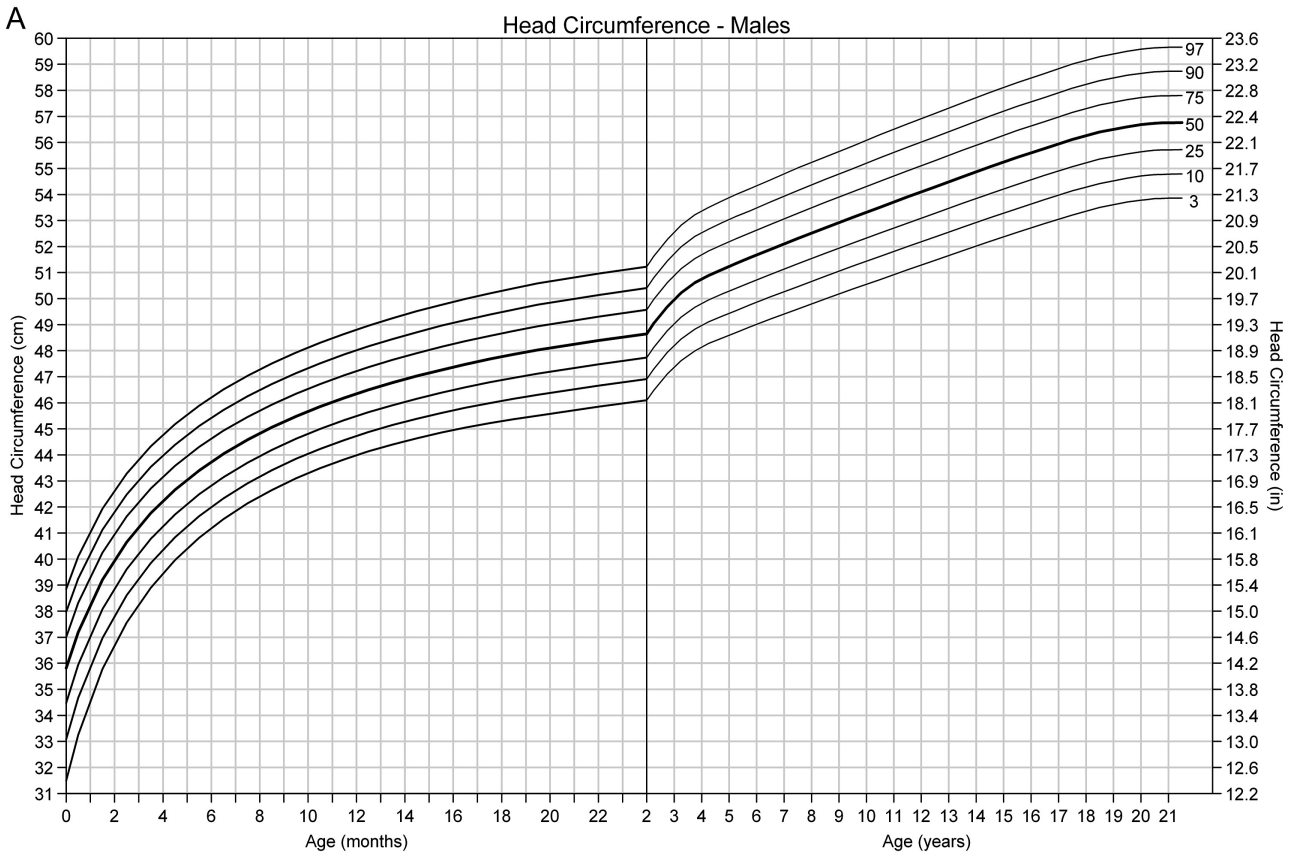


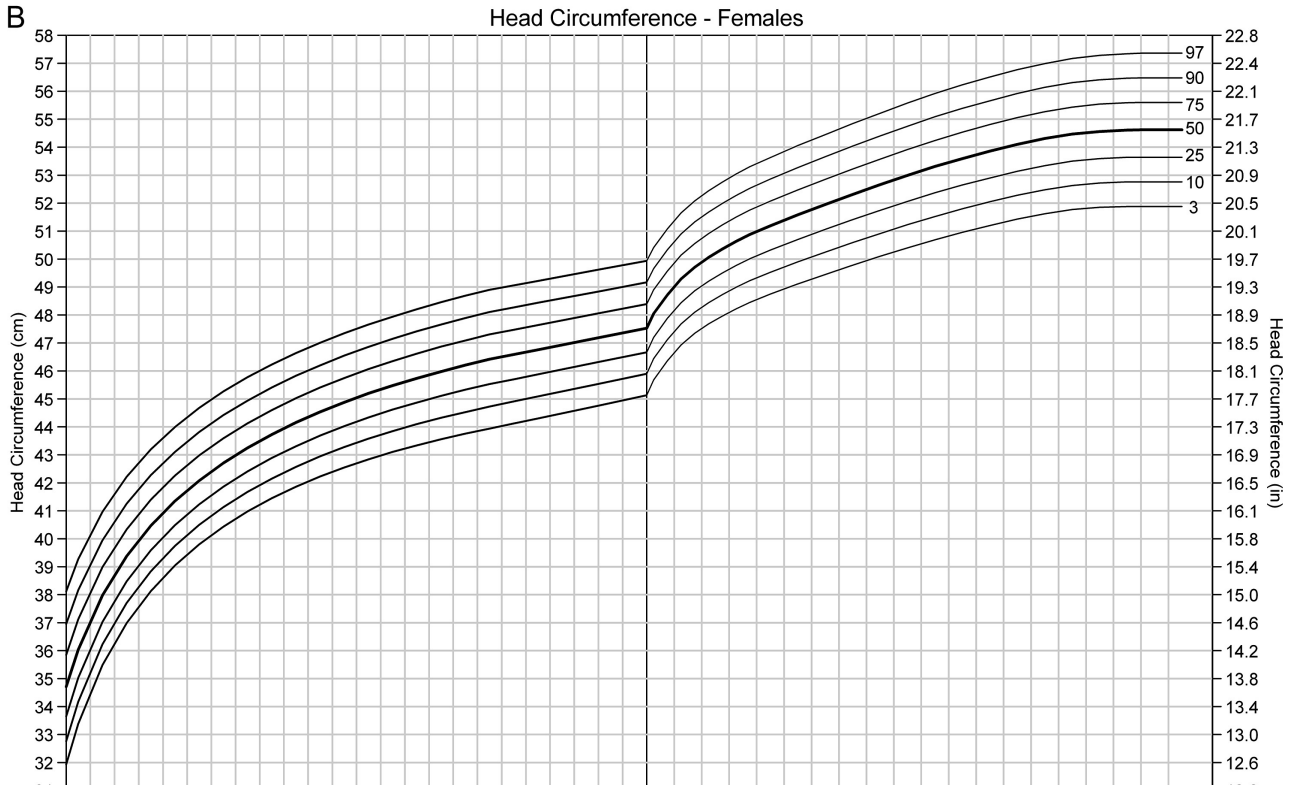
Figure 17. Head circumference for girls 0–5 years



Permission to reprint head circumference charts was granted by the WHO.

Figure 18. Head circumference for boys and girls 0–21 years





Source: Rollins JD, Collins JS, Holden KR. United States head circumference growth reference charts: birth to 21 years. J Pediatr. 2010 Jun;156(6):907-913.e2. Permission to reprint was granted by Elsevier.

Dysmorphology checklist

The three cardinal facial features (short palpebral fissures, smooth philtrum, and thin vermilion border of the upper lip) are essential elements of the diagnostic criteria. However, there are several other physical features that have been observed in FASD, which are medically inconsequential but can be subtle cues of an underlying diagnosis. These features are termed minor anomalies, to distinguish them from major anomalies that are birth defects of significant medical consequence. Minor anomalies in isolation do not individually represent the presence or absence of a condition and can be seen in the general population with some frequency. However, some minor anomalies are enriched in the FASD population. These anomalies are more common in patients with FAS and PFAS, but have also been noted occasionally in individuals with ARND. The checklist below provides a systematic method to document the primary features of FASD along with some of the minor anomalies that have been observed in FASD cases. It can be used both in clinical and research settings.

FASD Evaluation Worksheet
Dysmorphology Checklist

Gender: ☐ Male ☐ Female

Patient name: _____

Examiner: _____

Examination site: _____

Date of exam: Day ☐☐ Month ☐☐ Year ☐☐☐☐

Date of birth: Day ☐☐ Month ☐☐ Year ☐☐☐☐

Current age: Years ☐☐ Months ☐☐

Height (cm) ☐☐☐.☐	Percentile: ☐☐	≤ 10%	Significant?	Yes ☐ No ☐
Weight (kg) ☐☐☐.☐	Percentile: ☐☐	≤ 10%	Significant?	Yes ☐ No ☐
Head circumference (cm) ☐☐.☐	Percentile: ☐☐	≤ 10%	Significant?	Yes ☐ No ☐
Inner canthal distance (cm) ☐.☐	Percentile: ☐☐	≤ 25%	Significant?	Yes ☐ No ☐
Interpupillary distance (cm) ☐.☐	Percentile: ☐☐	≤ 25%	Significant?	Yes ☐ No ☐
Palpebral fissure-Left/Right (cm) ☐☐/☐.☐	Percentile: ☐☐	≤ 25%	Significant?	Yes ☐ No ☐
Outer canthal distance (cm) ☐.☐	Percentile: ☐☐			

Face: _____ Midface hypoplasia Yes ☐ No ☐

Ears: Cupped/low-set/railroad track ears Yes ☐ No ☐

Ears:

Strabismus	Unilateral/Bilateral	Yes ☐ No ☐
Ptosis	Unilateral/Bilateral	Yes ☐ No ☐
Epicanthal folds	Unilateral/Bilateral	Yes ☐ No ☐

Nose:

Flat nasal bridge	Yes ☐ No ☐
Anteverted nose	Yes ☐ No ☐

Philtrum lipometer code:	1 2 3 4 5	Yes ☐ No ☐
Lip lipometer code:	1 2 3 4 5	Yes ☐ No ☐

Mouth:

Prognathism		Yes ☐ No ☐

General:

Hypoplastic nails	Unilateral/Bilateral	Yes ☐ No ☐
5th finger clinodactyly	Unilateral/Bilateral	Yes ☐ No ☐
Camptodactyly	Unilateral/Bilateral	Yes ☐ No ☐
Creases:		Yes ☐ No ☐
Hockey stick crease	Unilateral/Bilateral	
Single transverse crease	Unilateral/Bilateral	
Hypoplastic thenar crease	Unilateral/Bilateral	

Arms:

Decreased pronation/supination	Yes ☐ No ☐

Heart:

Atrial septal defect	Yes ☐ No ☐
Ventricular septal defect	Yes ☐ No ☐
Other heart defect	Yes ☐ No ☐

Additional notes:

Neuropsychology

The direct effects of alcohol on the developing forebrain lead to a specific constellation of neurobehavioral impairments in children with FASD.[15] In order to assess the degree of neurologic impact from PAE, a comprehensive neuropsychological assessment evaluating the following three domains should be performed:

1. Global intellectual ability (full-scale IQ, verbal IQ, performance IQ, or spatial IQ)
2. Cognition (executive functioning, learning, memory, and visual-spatial skills)
3. Behavior and self-regulation (mood, behavioral regulation, attention, and impulse control)

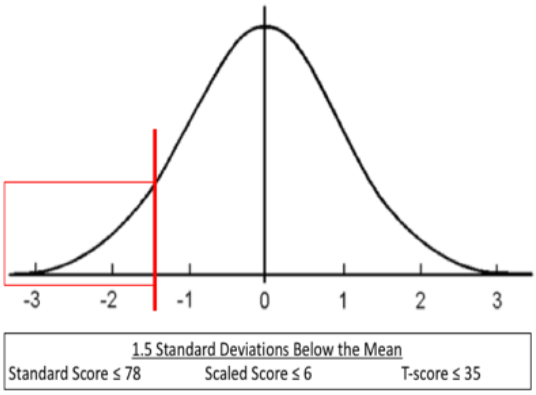
Based on the Hoyme (2016) criteria, impairment is defined as 1.5 standard deviations (SD) from the mean. Table 1 lists types of scores commonly reported for neuropsychological assessments.

Table 1. Scores commonly reported for neuropsychological assessments

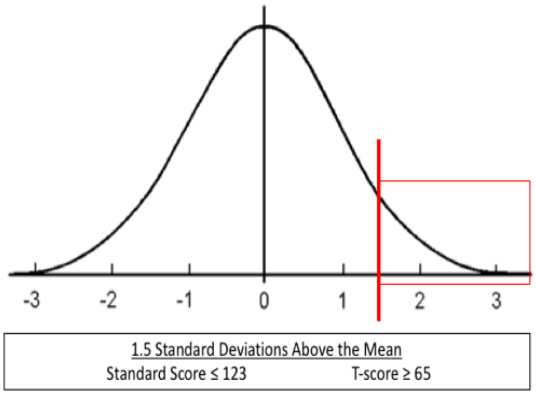
Type of score	Mean	SD	Examples
Standard Score (SS)	100	15	WISC-IV Index scores, ENI-2 Composite scores
Scaled Score (Sc)	10	3	WISC-IV Subtest scores, ENI-2 Subtests
T-Scores (T)	50	10	Measures of behavior (e.g., SENA)

When assessing cognition, impairment is defined as a deficit of 1.5 SD below the mean, which is equivalent to less than the 7th percentile. Conversely, when assessing behavior, impairment is defined as a score that is 1.5 SD above the mean, which is equivalent to greater than the 93rd percentile. The image below demonstrates this graphically.

For cognitive scores where low scores reflect poorer performance or weaker skills:



For behavioral scores where high scores reflect more problems:



The neurobehavioral impairment required for an FAS or PFAS diagnosis in children older than 3 years of age is defined as a deficit of 1.5 SD below the mean in global intellectual ability OR **one** cognitive domain. The neurobehavioral impairment can also be met with a deficit of 1.5 SD below the mean in at least **one** behavioral and self-regulation domain.

Due to the lack of physical findings, the neurobehavioral impairment required for an ARND diagnosis is more stringent. In ARND, it is defined as a deficit of 1.5 SD below the mean in global intellectual ability OR **two** cognitive domains. The neurobehavioral impairment for this diagnostic category can also be met with a deficit of 1.5 SD below the mean in at least **two** behavioral and self-regulation domains.

For children younger than 3, developmental delay is sufficient to meet the neurobehavioral impairment criteria for an FAS or PFAS diagnosis, but not for the diagnosis of ARND. This is because developmental delay is common, non-specific, and may be temporary.

Based on the authors' previous experience conducting trainings in Latin American countries, a battery of neuropsychological tests that assess for all three neurobehavioral domains is listed below. The neuropsychological assessment battery should be adjusted based on the individual child's abilities and needs, referral question, or clinician judgment. When available, neuropsychological assessments normed for a comparable population should be used.

Selected Assessment Instruments:

1. Global Impairment: Weschler Intelligence Scale for Children (WISC-IV)
2. Cognitive Impairment: Evaluación Neuropsicológica Infantil -2 (ENI-2)
3. Behavioral Impairment: Sistema de Evaluación de Niños y Adolescentes (SENA) - parent questionnaire

Table 2 lists the individual domains assessed in an FASD evaluation with the corresponding neuropsychological test from the selected battery. Table 3 lists additional neuropsychological assessments in Spanish.

Table 2. Individual domains assessed in an FASD evaluation

Domain	Tests/ subtests	Test battery/ abbreviation	Where normed	Age range
General cognitive ability	Wechsler Intelligence Scale for Children • Full Scale IQ (10 subtests) • Verbal Comprehension Index (3 subtests) • Perceptual Reasoning Index (3 subtests)	WISC-IV Spanish	USA, Mexico	Ages 6-16
Memory	Evaluación Neuropsicológica Infantil, 2nd Ed. • Encoding – Verbal (2 subtests) • Encoding – Visual (1 subtest) • Recall – Verbal (4 subtests) • Recall – Visual (4 subtests)	ENI-2	Mexico, Colombia	Ages 5-16
Executive functioning	Evaluación Neuropsicológica Infantil, 2nd Ed. • Verbal fluidity (3 subtests) • Graphical fluidity (2 subtests) • Cognitive flexibility (1 test, 3 main scores) • Planning and organizing (1 test, 4 main scores) Wechsler Intelligence Scale for Children • Working Memory Index (2 subtests)	ENI-2 WISC-IV Spanish	Mexico, Colombia USA, Mexico	Ages 5-16 Ages 6-16
Visual-spatial	Evaluación Neuropsicológica Infantil, 2nd Ed. • Graphic abilities (3 subtests) • Spatial abilities (5 subtests)	ENI-2	Mexico, Colombia	Ages 5-16
Learning	Evaluación Neuropsicológica Infantil, 2nd Ed. • Reading (10 possible subtests to choose from) • Writing (8 possible subtests to choose from) • Arithmetic (10 possible subtests to choose from)	ENI-2	Mexico, Colombia	Ages 5-16
Behavior functioning	Sistema de Evaluación de Niños y Adolescentes	Questionnaire	Spain	Ages 3-18
Perceptual skills (note: not part of FASD diagnosis but included as part of memory delay in ENI)	Evaluación Neuropsicológica Infantil, 2nd Ed. • Tactile (2 subtests) • Visual (5 subtests) • Auditory (3 subtests)	ENI-2	Mexico, Colombia	Ages 5-16

Table 3. Additional neuropsychological assessments in Spanish

Domain	Tests/ subtests	Test battery/ abbreviation	Where normed	Age range
Development	Bayley Scales of Infant and Toddler Development (III) Psychomotor Development Test	Bayley-3 TEPSI	USA	Ages 1-42 months Ages 2-5
General cognitive ability	Differential Abilities Scale – 2 Early Years British Ability Scales Wechsler Preschool and Primary Scale of Intelligence Wechsler Intelligence Scale for Children Wechsler Abbreviated Scales of Intelligence Wechsler Nonverbal Scale of Ability Reynolds Intellectual Assessment Scales	DAS-II BAS-II WPPSI-III WISC-IV Spanish WASI-II WNV RIAS	USA Spain USA, Mexico USA, Mexico USA USA Spain	Ages 2.5-6 Ages 2.5-17 Ages 2.5-7.5 Ages 6-16 Ages 6-90 Ages 4-21 Ages 3-94
Verbal memory	Recall of Digits Forward Sentence Repetition Narrative Memory List Memory / Delayed Test of Memory and Learning	DAS-II NEPSY-II NEPSY-II NEPSY-II TOMAL	USA USA USA USA Spain	Ages 2.5-17 Ages 3-6 Ages 3-16 Ages 7-12 Ages 5-19
Non-verbal memory	Recognition of Pictures Recall of Objects Memory for Faces / Delayed Memory for Designs / Delayed Test of Memory and Learning Rey Complex Figure Test	DAS-II DAS-II NEPSY-II NEPSY-II TOMAL REY	USA USA USA USA Spain Spain	Ages 2.5-17 Ages 4-17 Ages 5-16 Ages 3-16 Ages 5-19 Ages 4-15
Working memory	DAS-II/BAS-II Working Memory Composite WISC-IV Working Memory Index Word List Interference	DAS-II, BAS-II WISC-IV NEPSY-II	USA, Spain USA, Mexico USA	Ages 3.5-17 Ages 6-16 Ages 7-16
Executive functioning	Auditory Attention & Response Set Inhibition Animal Sorting Word Generation Design Fluency Batería Neuropsicológica de Funciones Ejecutivas y Lóbulos Frontales Evaluación Neuropsicológica de las Funciones Ejecutivas en Niños STROOP Color and Word Test Wisconsin Card Sorting Test Behavior Rating Inventory for Executive Functioning	NEPSY-II NEPSY-II NEPSY-II NEPSY-II NEPSY-II BANFE ENFEN STROOP WCST Questionnaire	USA USA USA USA USA Mexico Spain Spain Spain USA, Spain	Ages 5-16 Ages 5-16 Ages 7-16 Ages 3-16 Ages 5-12 Ages 6-80 Ages 6-12 Ages 7-80 Ages 6-89 Ages 2.5-5, 5-18
Visual-spatial	Arrows Geometric Puzzles Design Copying Developmental test of Visual Motor Integration Frosting Developmental Test of Visual Perception Rey Complex Figure Test	NEPSY-II NEPSY-II NEPSY-II VMI DTVP-3 REY	USA USA USA USA Mexico Spain	Ages 5-16 Ages 3-16 Ages 3-16 Ages 2-99 Ages 4-12 Ages 4-15
Attention & information processing	Auditory Attention & Response Set Children Sustained Attention Task - Revised	NEPSY-II CSAT-R WISC-IV, WPPSI	USA Spain USA, Mexico	Ages 5-16 Ages 6-11 Ages 4-16
Behavior functioning	Child Behavior Checklist Behavior Assessment System for Children Sistema de Evaluación de Niños y Adolescentes	Questionnaire Questionnaire Questionnaire	USA USA, Spain Spain	Ages 1.5-5, 6-18 Ages 2-5, 6-11, 12-21 Ages 3-18

General rules for the administration of neuropsychological testing in young children

General Introduction to Testing

- Build rapport with the child; younger children may need more time to be comfortable or separate from parents. Briefly describe the type of tasks: looking at pictures, answering questions, working with blocks.
  - Avoid “playing games.”
- Mention some things will be easy and some will be harder.
- You can say we don’t expect you to know how to do all of them, just try your best.
- Tell them you can take a break or go to the bathroom if needed.
- Ask if they have any questions.

General Tips on Managing Effort & Behavior

- Praise effort throughout testing and when the child needs encouragement; avoid giving the child any indication of right/wrong unless instructions say to (e.g., nodding, “ok,” “good”)
  - “You’re working hard!” “Way to work.”
  - “I like how you are thinking so hard about these.”
- Be fun and engaging.
- Try to avoid too much conversation between subtests. Moving smoothly from one test to the next will help keep time to a minimum and the child on task.
- Avoid having any unnecessary materials on the table.
- If the child is getting very frustrated or refusing to come to the table, try offering some choices (e.g., walk to the table like a penguin or elephant, choose which pencil to use, take a break now or after the next subtest, turn the pages) – praise heavily if they make an appropriate choice.
- Use statements instead of questions when you want the child to do something.
- Take breaks when needed. Avoid a break in the middle of a subtest unless it is absolutely necessary.
- Do not have the child eat during testing as the materials may get dirty or it may interfere with their performance. Encourage to have a snack during breaks.
- Materials are very expensive and hard to replace. Do not let children mistreat materials (e.g., bend cards, mess with bindings)
- Never force the child to continue if they protest. Going to talk to a parent can help.
- Sticker charts or count downs can be useful for keeping the child engaged.
  - Note that these may need to be prepared in advance.
- You may offer children a small prize for completing the assessment. This may be a useful incentive for getting them to continue participating. Use judgment when employing this strategy.

KEY POINT: You must try to be as precise as possible. Say the words exactly as written without adding anything extra or skipping any words. Pay close attention to what you should be pointing to and how the materials should be placed. This all is necessary for the resulting scores to be valid. Everything should be the same for all kids, just as was done when the test was created and normed.

Case examples

Prenatal alcohol exposure

Case 1

A 12-year-old male, Genaro, is having difficulty in school with memory retention, inattention, and hyperactivity. He is accompanied to clinic by his mother and paternal grandmother. When the pregnancy history is reviewed, the mother reports not drinking at all during her pregnancy. However, the paternal grandmother states that the mother is a "habitual drinker," often having multiple glasses of wine daily. The mother responds that she usually has some wine with dinner 2-3 times per week, but remains adamant that she did not drink during her pregnancy with Genaro.

Growth parameters for Genaro (height, weight, and head circumference) are normal. Physical examination shows a hockeystick crease on the right hand, and railroad tracking on the right ear. Palpebral fissure length is at the 12th percentile. Lip is a grade 4 and philtrum is a grade 3.

Neuropsychologic assessment reveals >1.5 standard deviation reduction in one domain that assesses memory impairment. The remainder of the assessment is normal.

1. Based on the information presented, can prenatal alcohol exposure be confirmed for Genaro?
2. Which FASD diagnostic categories should be considered for Genaro? Which ones can be excluded?
3. What additional information might be helpful in assessing Genaro?
4. What are some ways that the situation can be handled so that the environment is more conducive to elicit necessary information?

Case 2

A 21-year-old pregnant woman, Luisa, comes to clinic for her first prenatal visit. She found out she was pregnant one week ago by using an at-home pregnancy test. She is concerned because she was at a party three weeks ago and consumed six mixed drinks. When further questioned, she stated she was not sure of the amount of liquor in the drinks, but that it was predominantly rum mixed with cola. The first day of her last menstrual cycle was five weeks ago. Medical evaluation demonstrates a pregnancy at six weeks gestation.

1. Does the level of drinking in this case meet the threshold for prenatal alcohol exposure?
2. How would you counsel the patient regarding the risk to the embryo in this scenario?
3. If the event was repeated in the first trimester, how would the risk change?
4. If the event was repeated in the second trimester, how would the risk change?

Case 3

A 33-year-old pregnant female, Sofia, presents for a routine prenatal visit at 20 weeks gestation. During her visit, Sofia reports that she drinks once a week. When she drinks, she normally has about five beers. She drank seven beers at a party six months ago, but that happened only once in the past year. She never has difficulty stopping once started and has not had any issues with going to her job. After a night of heavy drinking, she feels that a cup of coffee in the morning is sufficient to start her day. She has no guilt about her drinking, but reported one episode in the past year when she couldn't remember what happened during a night of drinking. She has never been injured and no one in her social circle has ever expressed concern about her drinking.

1. What tool could be used to assess the risk level of her drinking? What other piece of information is necessary in assessing a more accurate risk?
2. Does the case scenario meet the criteria for prenatal alcohol exposure?

3. What findings on an ultrasound from today's visit would be suspicious for an FASD?

4. If the ultrasound was normal, what findings might still be present but missed by ultrasound?

5. How would you counsel this patient regarding the future? What plan would you put in place for appropriate surveillance?

Case 4

A 3-year-old female, Maria, is brought in for evaluation for possible FASD. She is accompanied by a foster parent who has limited knowledge regarding the biological mother of Maria or the pregnancy. She brings records that state the following:

"Maria was removed from the home at age 2 years after it was witnessed that the mother and father were using methamphetamine in her presence. Hair samples from Maria tested positive for the drug. Maria was then returned to the parents' care after a drug monitoring plan was put in place. At 2 years 3 months, during a home visit, a case worker observed the biological mother giving Maria a bottle that was later determined to contain vodka. The mother was tested and found to have a blood alcohol concentration of 0.385 mg/L. Maria was then removed for the final time from the home. The biological mother entered a substance abuse program. Unfortunately, she failed to complete the program and continues to abuse alcohol and methamphetamine.

"Medical records reveal that the biological mother had three other children, Juan, Jose, and Andrea. Juan underwent cord blood testing at birth, which was positive for alcohol. Juan was removed from the care of the mother due to the cord blood test. Jose and Andrea were later removed from the care of the mother due to concerns of physical neglect and hair testing that was positive for marijuana and methamphetamine. The father of the children died unexpectedly of unknown cause. Maria never underwent cord blood testing."

Growth parameters for Maria (height, weight, and head circumference) are normal. Physical examination shows no abnormalities. Palpebral fissure length is at the 25th percentile. Lip is a grade 3 and philtrum is a grade 2.

Questions:

1. Based on the information presented, can prenatal alcohol exposure be confirmed for Maria? Juan? Jose and Andrea?

2. Which FASD diagnostic categories should be considered for Maria? Which ones can be excluded?

3. What additional information might be helpful in assessing Maria?

4. Which FASD diagnostic categories should be considered for Juan?

5. What additional information might be helpful in assessing Juan?

6. Are Jose and Andrea at risk for an FASD?

Answer key

Case 1

1. Based on the information presented, can prenatal alcohol exposure be confirmed for Genaro? *No*

2. Which FASD diagnostic categories should be considered for Genaro? *ARND is a consideration, though further information regarding the maternal drinking early in the pregnancy is necessary. A comprehensive neuropsychological assessment must also be conducted.*
   Which ones can be excluded? *FAS, PFAS, and ARBD are excluded based on the lack of physical findings.*

3. What additional information might be helpful in assessing Genaro? *Questions regarding maternal alcohol use in the three months prior to the pregnancy and the period before she was aware that she was pregnant should be asked.*

4. What are some ways that the situation can be handled so that the environment is more conducive to elicit necessary information? *Removing the grandparent from the room, building rapport with the patient, and normalizing the behavior are important to ensuring trust and eliciting a positive response when the behavior is seen as associated with stigma.*

Case 2

1. Does the level of drinking in this case meet the threshold for prenatal alcohol exposure? *No, because there is only one episode of drinking reported.*

2. How would you counsel the patient regarding the risk to the embryo in this scenario? *This is the all-or-none period of pregnancy, so one can reassure the patient but with caution that additional episodes may cause harm.*

3. If the event was repeated in the first trimester, how would the risk change? *There would be sufficient exposure to meet the threshold for the criteria. This is the embryonic period, so birth defects, stillbirth, growth deficiency, neurobehavioral impairment, and facial features can occur with exposure at this time.*

4. If the event was repeated in the second trimester, how would the risk change? *After the embryonic phase, the primary risks are for growth deficiency and neurobehavioral impairment.*

Case 3

1. What tool could be used to assess the risk level of her drinking? *The AUDIT-C can be used, since this information contains all three components of the questionnaire.*
   What other piece of information is necessary in assessing a more accurate risk? *Her definition of a "beer" needs to be converted into a standard equivalent.*

2. Does the case scenario meet the criteria for prenatal alcohol exposure? *Yes, both as one can of beer (1 SDE = AUDIT-C score of 5) and as one liter of beer (4 SDE = AUDIT-C score of 9).*

3. What findings on an ultrasound from today's visit would be suspicious for an FASD? *Reduced growth parameters (crown-rump length, estimated weight, head circumference).*

4. If the ultrasound was normal, what findings might still be present but missed by ultrasound? *Facial dysmorphology and neurobehavioral impairment.*

5. How would you counsel this patient regarding the future? What plan would you put in place for appropriate surveillance? *The amount of alcohol exposure to this infant is high. The greatest risk for physical findings is in the second six weeks post-conception (gestational age 6-12 weeks). For example, for every one drink increase in the average number of drinks consumed, there was a 25% increased risk for smooth philtrum, 22% increased risk for thin upper lip, 12% increased risk for microcephaly, and 16% increased risk for reduced birth weight. The pregnancy should be monitored for intrauterine growth deficiency and extensive counseling regarding alcohol consumption should be provided. The newborn should be followed for any physical findings and a neuropsychological assessment will be necessary at 3-5 years of age to assess for impairment.*

Case 4

1. Based on the information presented, can prenatal alcohol exposure be confirmed for Maria? *No*
   Juan? *Yes*
   Jose and Andrea? *No*

2. Which FASD diagnostic categories should be considered for Maria? *ARND would be a consideration if more information can be obtained regarding prenatal alcohol exposure.*
   Which ones can be excluded? *FAS, PFAS, and ARBD are excluded based on the lack of physical findings.*

3. What additional information might be helpful in assessing Maria? *If she can be located, an interview or tool*

such as the timeline follow-back method could be utilized. Additionally, collateral information can be used if there is legal evidence of a DUI or a positive BAL during or in the three months leading up to the pregnancy.

4. Which FASD diagnostic categories should be considered for Juan? *All of them.*

5. What additional information might be helpful in assessing Juan? *Growth parameters, facial dysmorphology, and neuropsychology is necessary to determine if he has an FASD.*

6. Are Jose and Andrea at risk for an FASD? *Not based on the available information, though the historical drinking pattern is concerning.*

Comprehensive FASD evaluation

CASE #1 (Age 9yr-10mo girl)

Case #1 lives with her adoptive mother and older biological sister. She was born at 27 weeks gestation. Prenatal exposure is confirmed for daily alcohol and marijuana use throughout pregnancy. She was removed from her biological mother at birth and spent three months in the Neonatal Intensive Care Unit. She was in foster care until 7 months of age and then went to live with her adoptive mother. She receives special education services at school in a small classroom setting. She has been diagnosed with ADHD and a mood disorder. She takes guanfacine and aripiprazole to manage attention and behavioral symptoms.

Dysmorphology Exam: Height 139 cm, weight 34 kg, OFC 53 cm, palpebral fissure length 2.4 cm. Lip and philtrum shown above. No history of seizures.

Selected Test Results:

Intellectual Functioning (WISC-IV)

Full Scale IQ Standard Score (SS) = 68, 2nd percentile

Academic Achievement (ENI-2)

Reading precision: words with errors in reading aloud Scaled Score (Sc) = 6, 13th percentile

Arithmetic: written calculus Sc = 3, 1st percentile

Writing precision: percent of words with errors in written recall Sc = 4, 2nd percentile

Verbal Memory (ENI-2)

Auditory-verbal memory SS = 60, <1st percentile

Auditory stimuli recall memory SS = 64, 1st percentile

Executive Functioning (ENI-2)

Cognitive flexibility: percentage of perseverative responses Sc = 3, 1st percentile

Planning and organizing: correct designs Sc = 4, 2nd percentile

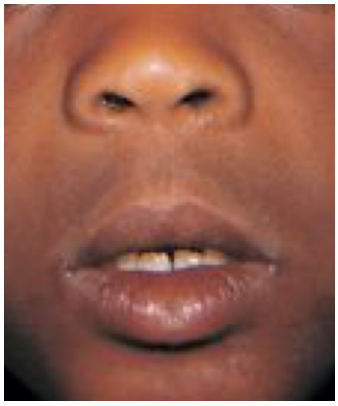
Behavior Problems (SENA) (*high scores = worse performance)

Attention difficulties T = 77, >99th percentile

Hyperactivity and impulsivity T = 65, 94th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:



CASE #2 (Age 7yr-7mo girl)

Case #2 lives with her biological mother. Her mother reports that she was in college when she got pregnant with the child and was binge drinking a lot on the weekends. She discovered she was pregnant when she was 3.5 months along. Upon pregnancy recognition, she stopped drinking and sought prenatal care. The child was diagnosed with ADHD at 5 years old and began medication to manage her inattention and hyperactivity. However, she continues to struggle at home and school with regulating her behavior. Although she tries hard, she gets in trouble a lot at school, especially during unstructured times of the day.

Dysmorphology Exam: Height 113 cm, weight 26 kg, OFC 49 cm. Palpebral fissure length 2.4 cm. Lip and philtrum shown above. No known history of seizures.

Selected Test Results:

Intellectual Functioning (WISC-IV)

Full Scale IQ SS = 106, 66th percentile

Academic Achievement (ENI-2)

Reading precision: words with errors in reading aloud Sc = 8, 25th percentile

Arithmetic: written calculus Sc = 8, 25th percentile

Writing precision: percent of words with errors in written recall Sc = 8, 25th percentile

Memory (ENI-2)

Auditory-verbal memory SS = 70, 2nd percentile

Auditory stimuli recall memory SS = 66, 1st percentile

Visual memory SS = 110, 75th percentile

Visual stimuli recall memory SS = 110, 75th percentile

Executive Functioning (Child testing; ENI-2)

Verbal fluidity SS = 100, 50th percentile

Planning and organizing: correct designs Sc = 4, 2nd percentile

Cognitive flexibility: percentage of perseverative responses Sc = 1, 1st percentile

Behavior Problems (SENA) (*high scores = worse performance)

Hyperactivity and impulsivity T = 68, 96th percentile

Attention difficulties T = 67, 96th percentile

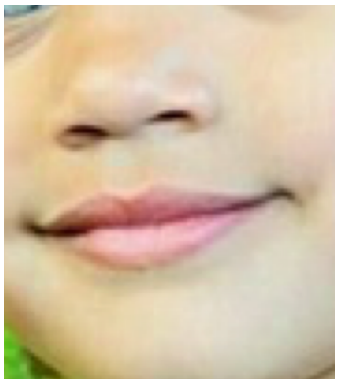
Emotional regulation problems T = 71, 98th percentile

Index of problems in executive functioning T-score = 73, 99th percentile

Anxiety T = 55, 70th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral Impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:



CASE #3 (Age 7yr-3mo boy)

Case #3 lives with his adoptive parents and their older biological daughter. He was born full term. He was exposed to 12-18 cans of beer per week throughout pregnancy. He came to live with his adoptive parents at 11 weeks old. His developmental milestones were on time. He has been treated for strabismus and has asthma. He is in a general education classroom. He has difficulties with attention and anxiety, although does not take any medications and has not received any prior mental health diagnosis or treatment.

Dysmorphology Exam: Height 126 cm, weight 23.3 kg, OFC 50 cm. Palpebral fissure length 2.7 cm. Lip and philtrum shown above. No history of seizures.

Selected Test Results:

Intellectual Functioning (WISC-IV)

Full Scale IQ SS = 88, 21st percentile

Academic Achievement (ENI-2)

Reading precision: words with errors in reading aloud Sc = 12, 75th percentile

Arithmetic: written calculus Sc = 3, 1st percentile

Writing precision: percent of words with errors in written recall Sc = 9, 37th percentile

Verbal Memory (ENI-2)

Auditory-verbal memory Sc = 95, 37th percentile

Visual memory Sc = 93, 32nd percentile

Behavior Problems (SENA) (*high scores = worse performance)

Hyperactivity and impulsivity T = 91, >99th percentile

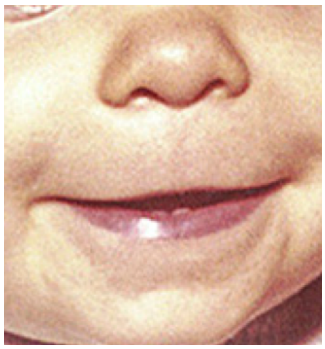
Attention difficulties T = 67, 96th percentile

Emotional regulation problems T = 70, 98th percentile

Index of problems in executive functioning = 76, >99th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:



CASE #4 (Age 6yr-1mo boy)

Case #4 is in foster care with his two siblings. His foster parent has limited information about his birth and early growth and development. He was removed from his mother's care when he was 3 years old when he was found wandering near the highway. His biological parents are known to have problems with drug and alcohol use. It is unknown if he was exposed to alcohol or other substances during pregnancy. Currently, he is in kindergarten.

Dysmorphology Exam: Weight 15.5 kg, height 106 cm, OFC 51 cm. Palpebral fissure length 2.3 cm. Lip and philtrum shown above. No history of seizures.

Selected Test Results:

Intellectual Functioning (WISC-IV)

Full Scale IQ SS = 105, 63rd percentile

Memory (ENI-2)

Auditory-verbal memory SS = 95 , 37th percentile

Visual memory SS = 105, 63rd percentile

Visual stimuli recall memory SS = 95, 37th percentile

Executive Functioning (Child testing; ENI-2)

Verbal fluidity SS = 100, 50th percentile

Cognitive flexibility: percentage of perseverative responses Sc = 3, 1st percentile

Behavior Problems (SENA) (*high scores = worse performance)

Hyperactivity and impulsivity T = 79, >99th percentile

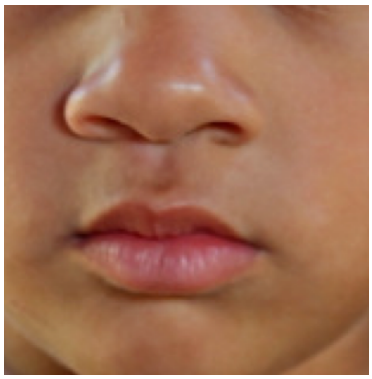
Attention difficulties T = 72, 99th percentile

Emotional regulation problems T = 69, 97th percentile

Index of problems in executive functioning = 72, 99th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:



CASE #5 (Age 8yr-9mo girl)

Case #5 lives with her aunt and uncle and their new baby. She has lived with them since she was 18 months old. Information about pregnancy, labor, and delivery with the child are largely unknown. The child's mother has struggled with severe mental illness, substance use, and homelessness. Prenatal exposure to alcohol and cocaine are suspected, but unconfirmed. When she came to live with her aunt she had limited language and her motor milestones appeared delayed. The child is in a special education classroom at school and receives a high level of services for behavior regulation support.

Dysmorphology Exam: Height 135.5 cm, weight 29 kg, OFC 52.5 cm. Palpebral fissure length 2.8 cm. Lip and philtrum shown above. No known history of seizures.

Selected Test Results:

Intellectual Functioning (WISC-IV)

- Verbal comprehension SS = 86, 18th percentile
- Perceptual reasoning SS = 76, 5th percentile

Academic Achievement (ENI-2)

- Reading precision: words with errors in reading aloud Sc = 8, 25th percentile
- Arithmetic: written calculus Sc = 5, 5th percentile
- Writing precision: percent of words with errors in written recall Sc = 8, 25th percentile

Memory (ENI-2)

- Auditory-verbal memory SS = 75, 5th percentile
- Auditory stimuli recall memory SS = 70, 2nd percentile
- Visual memory SS = 80, 9th percentile
- Visual stimuli recall memory SS = 75, 5th percentile

Spacial Skills (ENI-2) SS = 60, <1st percentile

Executive Functioning (Child testing)

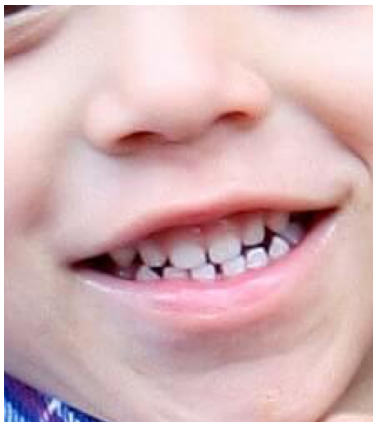
- WISC-IV Working memory SS = 70, 2nd percentile
- ENI-2 Cognitive flexibility: percentage of perseverative responses Sc = 1, <1st percentile
- ENI-2 Planning and organizing: correct designs Sc = 6, 9th percentile

Executive Functioning / Behavior Regulation (SENA *high scores = worse performance)

- Index of problems in executive functioning T-score = 83, >99th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:



CASE #6 (Age 3yrs-10 mo boy)

Case #6 was living with an extended relative and his biological older sister. He lived with his biological parents until the age of 34 months and was removed due to significant abuse and neglect. He was born full term via cesarean section. He was in the NICU for three days and was released to his parents. Reliable family members observed his mother drinking alcohol during her pregnancy on multiple occasions and she was noted to have a DUI while pregnant with the child. His developmental milestones were delayed. He has been expelled from multiple daycares due to aggression. He has been prescribed clonidine.

Dysmorphology Exam: Height 100.2 cm, weight 16.2 kg, OFC 49.5 cm. Palpebral fissure length 2.2 cm. Lip and philtrum shown above. No history of seizures.

Selected Test Results:

Intellectual Functioning (WPPSI-III)

Full Scale IQ SS = 76, 5th percentile

Memory

Visual memory SS = 72, 3rd percentile

Behavior Problems (SENA) (*high scores = worse performance)

Hyperactivity and impulsivity T = 74, 99th percentile

Emotional regulation problems T = 71, 98th percentile

Attention difficulties T = 67, 96th percentile

Index of problems in executive functioning T = 83, >99th percentile

Present/absent	Criteria	Notes
A. Characteristic pattern of minor facial anomalies, including two or more of the following:		
	1. Short palpebral fissures	
	2. Thin vermilion border of the upper lip	
	3. Smooth philtrum	
B. Growth deficiency		
	Height and/or weight less than or equal to 10th percentile	
C. Deficient brain growth, structural brain anomalies, or recurrent nonfebrile seizures		
	1. Head circumference < 10th percentile	
	2. Structural brain anomalies	
	3. Recurrent nonfebrile seizures	
D. Neurobehavioral impairment (more than 1.5 standard deviations below the mean)		
	1. Global impairment (IQ)	
	2. Cognitive impairment: impairment in executive functioning, specific learning impairment, memory, or visual-spatial **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
	3. Behavioral impairment: impairment in self-regulation as evidenced by mood or behavioral regulation, attention deficit, or impulse control **for FAS/PFAS need impairment in one area in this domain. For ARND need 2 areas of impairment in this domain**	
E. Evidence of prenatal alcohol exposure		
	Confirmation of prenatal alcohol exposure	

FINAL DIAGNOSIS:

Answer key

Final diagnosis:

Case 1: Alcohol-related neurodevelopmental disorder (ARND)

Case 2: Fetal alcohol syndrome (FAS)

Case 3: Alcohol-related neurodevelopmental disorder (ARND) with microcephaly

Case 4: Partial fetal alcohol syndrome (PFAS) without documented alcohol exposure

Case 5: No diagnosis of FASD

Case 6: Partial fetal alcohol syndrome (PFAS) with documented alcohol exposure

Post-diagnosis of FASD: Ethical challenges and suggested interventions

Ethical challenges

An assessment leading to the diagnosis of FASD has numerous benefits. Earlier diagnosis yields greater benefits for affected children, which include a reduction in secondary disabilities such as substance abuse and learning and cognitive disabilities leading to school failure, and improved life outcomes. Perhaps most importantly, diagnosis provides a context for understanding a child's behavior. When the environment surrounding a child with an FASD opts to focus on the child's strengths as a means for intervention, there is a greater likelihood of that child achieving success as an adult. Diagnosis of FASD is further beneficial to the extent that it leads to a reduction of future births of children with FASD.

However, to the extent that an FASD diagnosis presupposes prenatal alcohol exposure (PAE), it implies ethical challenges. PAE implies that maternal behavior led to the child's condition. Even in the absence of awareness of the risks of PAE, a diagnosis associated with maternal behavior may lead to stigmatization, attribution of blame to the mother, maternal guilt, altered family dynamics due to assignment of blame, and an impact on the maternal-child bonding process, especially when the diagnosis occurs during infancy.

Obtaining accurate information from women and families in order to produce an FASD diagnosis may be challenging on its own. Cultural practices surrounding alcohol use may reduce stigma associated with PAE in some parts of the world, resulting in greater willingness for women to disclose alcohol use, which in turn would facilitate an earlier FASD diagnosis. At the same time, other communities that have been highly impacted by FASD may respond more dramatically with laws designed to reduce PAE, which may negatively impact the frequency of disclosure by women, particularly during pregnancy when interventions are most likely to be effective.

Programs aimed at identifying children with FASD must be aware of these ethical challenges and consider the context of the community as it will define the experiences of the family in dealing with this diagnosis. It is imperative to seek paths that aim at maximizing the health and well-being of children and their mothers, on whom children often depend. Indeed, keeping the best interest of the child in mind also calls for advancing the health and well-being of the mother. Moreover, she may be in need of medical care herself (e.g., if she suffers from alcohol addiction) or psychological support resulting from the awareness that she did something that caused harm to her own child. Given that the majority of pregnancies are unplanned, so women are often unaware of their pregnancy in the most vulnerable gestational period, and that relatively low amounts of alcohol suffice to cause FASD, mothers' need of psychological support may be more common than previously envisioned. In general, it should be noted that greatest benefits for affected children result from advancing the health and well-being of these children's mothers.

Care should prevail to avoid imposing additional harms on affected children or their mothers, avoid interventions or messages that could antagonize mothers and their children, and overall to advance the health and well-being of both. Ethics guidance should be sought when FASD diagnosis poses further challenges.

Suggested interventions

The assignment of an FASD diagnosis to a patient, although essential, is only the initial step in the process of providing support for these individuals. Further action is needed to maximize the potential benefits of diagnosis. Any clinical diagnostic program must also establish protocols for referrals to appropriate specialists, and individuals with the diagnosis need access to resources that support their long-term success.

When an FASD diagnosis is suspected, it is imperative to initially exclude any other possible causes such as a genetic disorder that may require specific medical interventions. Often, if a patient has more findings than what would be expected in FASD, chromosomal analysis in the form of a microarray is performed. This is the standard initial test for any child with significant developmental delay or cognitive impairment when a definitive diagnosis is lacking.

If no other genetic condition exists, and the FASD diagnosis is definitive, assessments of sensory input from the environment necessary for development and the learning process are important. Annual ophthalmologic and audiologic screening is recommended to identify any visual or hearing issues that may delay motor or language development. Screening for some of the known congenital anomalies is also recommended, based on clinical judgement. For example, a cardiac murmur heard on examination may necessitate an echocardiogram to further evaluate for congenital heart disease that is known to have increased prevalence within the FASD population. Abnormal spine examination (restriction in movement or scoliosis) may warrant spine X-rays to evaluate for vertebral anomalies. Renal ultrasound is indicated in children with recurrent urinary tract infections to look for renal anomalies associated with FASD. Early referral to habilitation and rehabilitation services such as speech and language therapy or physical therapy can be important in optimizing function and social participation.

Some of the neurobehavioral issues associated with FASD can be treated pharmacologically, though there are no medications that are approved specifically for FASD. For example, hyperactivity associated with FASD may be treated with stimulant medication and mood disorders may be treated with selective serotonin uptake inhibitors. However, a pharmacologic approach alone without appropriate in-school interventions often results in a suboptimal treatment outcome.

For school-age children, educational support is vital and information regarding the ideal learning methodologies for children with FASD should be provided to school educators. Understanding the unique neurobiology of individuals with FASD can result in a more successful classroom experience and improved long-term outcomes for these patients as adults. Patients and their caregivers must be given access to information so that they may advocate for their needs to school officials and educators. Some school-based resources available free-of-charge can be found at https://www.cdc.gov/ncbddd/fasd/educators.html

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Saunders JB, Aasland OG, Babor TF, de la Puente JR, Grant M. Development of the Alcohol Use Disorders Screening Test (AUDIT). WHO collaborative project on early detection of persons with harmful alcohol consumption. II. Addiction. 1993;88:791-804.

The *Regional Status Report on Alcohol and Health in the Americas* published in 2015 describes five key recommendations based upon objectives described in the global strategy report by the WHO. This document serves to meet several of these objectives including raising awareness, improving the knowledge base about the magnitude of alcohol-related problems, and improving monitoring systems and surveillance.

The detailed descriptions of methodology used in the diagnosis of FASD along with the long-term outcome and intervention information provided is ideal for dissemination within countries of the Americas. The experiences of the authors working in North, Central, and South America provide a background of knowledge and understanding of the extent of the problem and the challenges faced by providers in these regions. Much of the content was developed with this in mind and includes examples of standard drinks, social and community factors, and support services available that would be relevant to the expected readership. The training manual provides information regarding the diagnostic process, the tools needed to perform the necessary assessments, and case-based learning modules to enhance learning and retention of critical elements for an FASD diagnosis. There are also components of the interventions provided to balance the training regarding diagnosis with an avenue to move forward that would be beneficial to patients.

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