

Impact of Alcohol and Cannabis on the Developing Baby



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General disclosures

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General disclosures

UW PACC is also supported by Coordinated Care of Washington

Speaker disclosures

✓ No conflicts of interest

PLANNER DISCLOSURES

The following series planners have no relevant conflicts of interest to disclose:

Mark Duncan MD

Barb McCann PhD

Anna Ratzliff MD PhD

Rick Ries MD

Kari Stephens PhD

Niambi Kanye

Betsy Payn

Diana Roll

Cara Towle MSN RN

Objectives

1. Impact of alcohol on the developing fetus.
2. Impact of cannabis on the breastfeeding infant.

What is Fetal Alcohol Syndrome (FAS)?

FAS is characterized by:

1. Growth deficiency
2. Unique facial features
3. CNS abnormalities (evidence of structural, neurological, or functional impairment)
4. Prenatal alcohol exposure

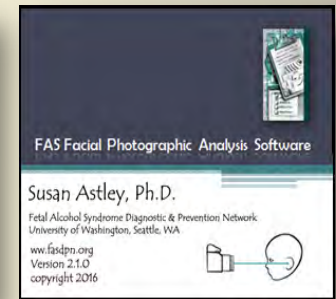
Prevalence: 1 to 3 per 1,000 live births (equivalent to down syndrome).

Leading known cause of developmental disabilities.

100% preventable.

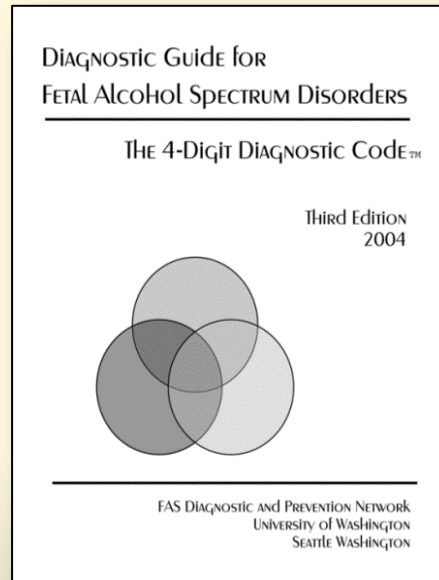
FASD evaluations conducted by an interdisciplinary team using the FASD 4-Digit Code

Center on Human Development & Disability



- Pediatrician
- Psychologist
- Speech Language Pathologist
- Occupational Therapist
- Social Worker
- Family Advocate

Observe a day in clinic on Fridays
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The FASD 4-Digit Code is Fully Validated

Astley SJ. [Validation of the fetal alcohol spectrum disorder \(FASD\) 4-Digit Diagnostic Code](#). J Popul Ther Clin Pharmacol Vol 20(3):e416-467;November 15, 2013.

WA State FAS Diagnostic & Prevention Network (fasdnpn.org)



VALIDATION OF THE FASD 4-DIGIT DIAGNOSTIC CODE
Susan Astley PhD
Professor Epidemiology/Pediatrics
Director WA FAS DPN
University of Washington
2013

Right mouse click sound icon, select 'play file' to listen to narration.

Audio Narrated pdf

<http://depts.washington.edu/fasdnpn/pdfs/astley-validation-2013post-audio.pdf>

VALIDATION OF THE FETAL ALCOHOL SPECTRUM DISORDER (FASD) 4-DIGIT DIAGNOSTIC CODE

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ABSTRACT

Background
The fetal alcohol spectrum disorder (FASD) 4-Digit Diagnostic Code has been used by interdisciplinary diagnostic teams worldwide for 17 years. It was created to improve the ease, accuracy, and reproducibility of diagnosis across the full spectrum of FASD. Over the years, a number of FASD diagnostic guidelines have been proposed. As the field of FASD moves forward, it will be important to adopt a single set of diagnostic guidelines worldwide. To achieve this, the performance (validity) of current diagnostic guidelines must be rigorously assessed and reported.

Objective
To summarize the body of evidence that has amassed over 20 years that validates the performance of the FASD 4-Digit Diagnostic Code.

Methods
The evidence validating the 4-Digit Code is documented across 25 studies published between 1997 and 2013, including new information presented in this report. These studies and data sources include the delineation of the FAS facial phenotype; creation of the 4-Digit Code (1987-2004); our 10-year, foster-care FAS screening program; our MRJEMRIMES studies; analysis of 1,350 individuals evaluated for FASD over 20 years in the WA State FASDPN clinic; and analysis of 622 patient satisfaction/follow-up surveys; survey of 10,000 professionals attending the University of Washington FASD diagnostic clinic trainings; and survey of over 700 professionals worldwide who completed the 4-Digit Code Online Course.

Conclusion
The 4-Digit Code is a simple, comprehensive, evidence-based, validated diagnostic system. It has served as the cornerstone of a fully integrated FASD screening, diagnostic, intervention, prevention, and surveillance program in Washington State for the past 20 years.

Key Words: Fetal alcohol spectrum disorders (FASD); fetal alcohol syndrome (FAS); diagnosis; validity; 4-Digit Diagnostic Code; FAS Diagnostic & Prevention Network (FASDPN)

The fetal alcohol spectrum disorder (FASD) 4-Digit Diagnostic Code has been used by interdisciplinary diagnostic teams worldwide for 17 years (Figure 1).¹⁻⁷ It was created to improve the ease, accuracy, and reproducibility of diagnoses across the full spectrum of FASD.⁸ Over the years, a number of FASD diagnostic guidelines have been proposed.⁹⁻¹⁴ As the field of FASD moves forward, it will be important to adopt a single set of diagnostic guidelines worldwide.⁸ To achieve this, the performance (validity) of current diagnostic guidelines must be rigorously assessed and reported. The purpose of this report is to pull together the body of evidence that has amassed over 20 years that validates the performance of the FASD 4-Digit Diagnostic Code. This report highlights key evidence, directing readers to the source publications for more details.

J Popul Ther Clin Pharmacol Vol 20(3):e416-467; November 15, 2013
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e416

Published Paper

<http://depts.washington.edu/fasdnpn/pdfs/validation2013FAR.pdf>

FASD 4-Digit Diagnostic Code

Abbreviated Case-Definitions of 4-Digit Code

	3	4	3	4
Rank 4	H and W ≤ 3 %	All 3 features	Structural / Neurological Abnormalities	Confirmed High
Rank 3	H or W ≤ 3 %	2.5 features	Severe Dysfunction	Confirmed
Rank 2	H and W all else	1-2 features	Moderate Dysfunction	Unknown
Rank 1	H and W > 10 %	No features	No Dysfunction	Confirmed Absent
	Growth	Face	CNS	Alcohol



4-Digit Codes cluster into Diagnostic Categories

FAS / Alcohol Exposed

2433 3433 4433 2434 **3434** 4434
2443 3443 4443 2444 3444 4444

PFAS / Alcohol Exposed

1333 1433 2333 3333 4333
1334 1434 2334 3334 4334
1343 1443 2343 3343 4343
1344 1444 2344 3344 4344

4 Diagnoses under the FASD Umbrella

	Diagnosis	Growth	FAS Face	CNS	Alcohol
1. FAS	Fetal Alcohol Syndrome	growth	face	severe	alc
2. PFAS	Partial FAS		face	severe	alc
3. SE/AE	Static Encephalopathy / Alc Exposed			severe	alc
4. ND/AE	Neurobehavioral Disorder / Alc Exposed			moderate	alc

Diagnostic Outcomes in Washington State

Among 3,000 patients (birth –adult) with prenatal alcohol exposure evaluated at the FASDPN clinic over the past 27 years:

4 Diagnoses under the FASD Umbrella

5 %
5 %
25 %
45 %

Diagnosis		Growth	FAS Face	CNS	Alcohol
1. FAS	Fetal Alcohol Syndrome	growth	face	severe	alc
2. PFAS	Partial FAS		face	severe	alc
3. SE/AE	Static Encephalopathy / Alc Exposed			severe	alc
4. ND/AE	Neurobehavioral Disorder / Alc Exposed			moderate	alc

Gender, Racial and Age Profile of 3,000 Patients

Gender, Age	Clinic
Male	58%
0-3 yrs	18 %
4-6 yrs	17%
6-15 yrs	55%
16 + years	10 %

Race	Clinic	WA State
White	49 %	82%
Black	7 %	3 %
Native American/Alaskan	8 %	2 %
Asian	< 1 %	6 %

Mental Health Profile of 1,400 Patients with FASD

Characteristic	FASD Diagnostic Subgroups									
	1. 59 FAS/ 95 PFAS N = 154		2. SE/AE N = 394		3. ND/AE N = 722		4. Normal CNS/AE N = 130		Total N = 1400	
Mental Health Disorders: N (valid%)										
One or more disorders	73	71.6	180	84.1	293	74.0	10	28.6	546	74.5
ADD/ADHD	53	59.6	161	59.9	233	55.2	0	0	447	53.9
Adjustment Disorder	4	2.6	8	2.0	29	4.0	3	2.3	44	3.1
Antipersonality Disorder	0	0	0	0	1	0.1	0	0	1	0.1
Anxiety Disorder	2	1.3	10	2.5	8	1.1	0	0	20	1.4
Reactive Attachment Disorder	6	3.9	19	4.8	27	3.7	2	1.5	54	3.9
Bipolar/Manic Depression	4	2.6	10	2.5	13	1.8	3	2.3	30	2.1
Conduct Disorder	2	1.3	16	4.1	24	3.3	1	0.8	43	3.1
Depression	7	4.5	23	5.8	32	4.4	2	1.5	64	4.6
Dysthymic Disorder	3	1.9	7	1.8	23	3.2	2	1.5	35	2.5
Obsessive Compulsive Disorder	1	0.6	6	1.5	2	0.3	0	0	9	0.6
Oppositional Defiant Disorder	8	5.2	39	9.9	72	10.0	1	0.8	120	8.6
Post Traumatic Stress Disorder	10	6.5	32	8.1	49	6.8	4	3.1	95	6.8
Suicidal	2	1.3	3	0.8	5	0.7	0	0	10	0.7

Prevalence of Marijuana use during Pregnancy

Other Adverse Prenatal Exposures among 1,400 patients		
	N	%
Any exposure	975	93
Tobacco	861	62
Marijuana	503	37
Crack/cocaine	521	38
Methamphetamines	102	7
LSD	47	3
dilantin	8	0.6

Prevalence of FAS/D

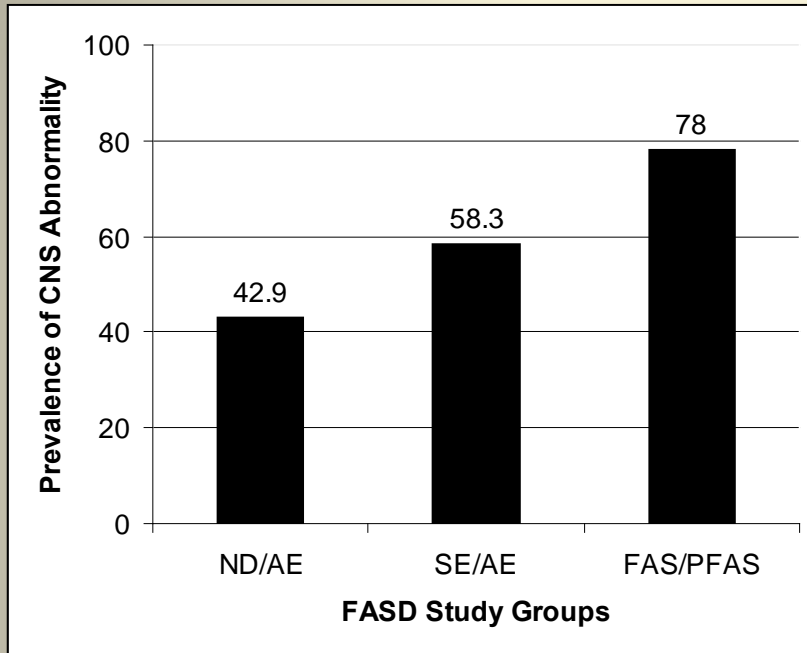
Prevalence of FAS	
General population	1 / 1,000
Foster Care	1 / 100
FASD Clinic	1 / 10

For every child with FAS, there are 10 times more with FASD

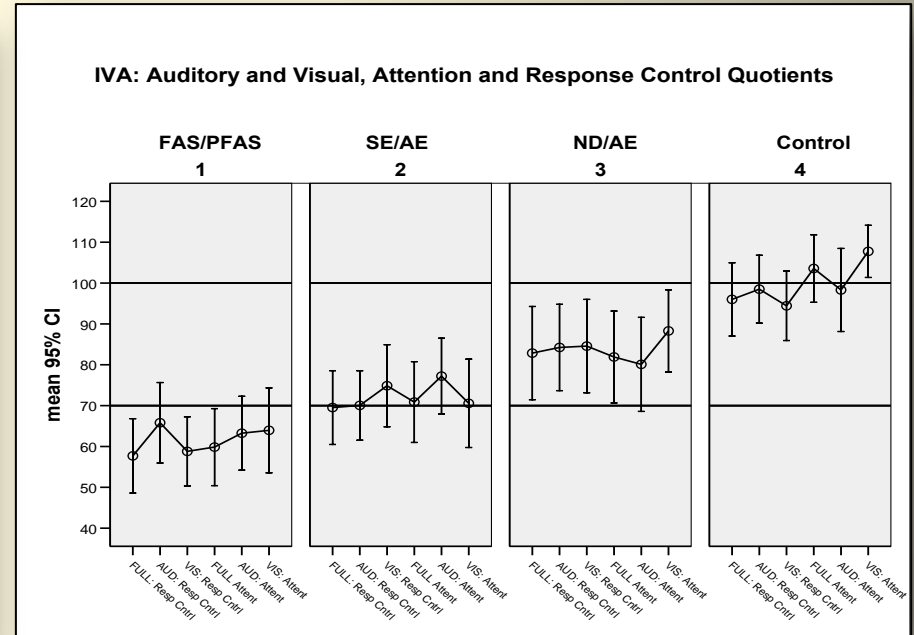
Prevalence of FASD	
FASD	1/100
Autism	1 / 45

Prevalence of FAS	
FAS	1/1000
Down syndrome	1 / 1000

Structural and Functional Brain Abnormalities



Brain Structure



Brain Function

The structural and functional abnormalities of the brain become more severe as you advance from ND/AE to SE/AE to FAS/PFAS.

Delayed Effects of FASD

“...children exposed to and damaged by prenatal alcohol exposure do deceptively well in their preschool years. The full impact of their alcohol exposure on brain function will not be evident until later in childhood.”

Over half of the children with full FAS seen in the FASDPN Clinic had Bayley developmental outcomes within the normal range, only to present with severe brain dysfunction later in childhood.

How do you know which infants with prenatal alcohol exposure and normal early development will present with severe brain dysfunction later in childhood?

Our recent study (Astley, Bledsoe, Davies, 2016) confirmed the presence of sentinel physical features (growth deficiency, FAS facial features and/or microcephaly) accurately predict which alcohol-exposed infants will present with severe brain dysfunction later in childhood.

The only safe amount of alcohol for ALL fetuses is none at all.

- The higher the consumption, the higher the risk of FASD.
- Because the fetal brain continues to develop throughout pregnancy, there is no safe time for a woman to drink while pregnant. However, if a woman drinks during pregnancy, the risk can be reduced if the woman stops or reduces her drinking. It is never too late to stop.
- Some fetuses are more vulnerable to the adverse effects of alcohol than others. Genetics plays a role. Despite identical alcohol exposures, dizygotic twins can present at opposite ends of the spectrum (FAS vs normal). Monozygotic twins present with identical FASD outcomes. *Astley et al., 2019 Twin study posted on www.fasdnpn.org*

4-Digit Code FAS Face (Rank 4)

- | | |
|--------------------|--------------|
| 1) Short PFL | ≤ -2 SD |
| 2) Smooth Philtrum | Rank 4 or 5 |
| 3) Thin Upper Lip | Rank 4 or 5 |



Palpebral fissure length (PFL) = endocanthion to exocanthion



FAS



Free Digital Lip-Philtrum Guides

For use on your smartphone
or computer tablet

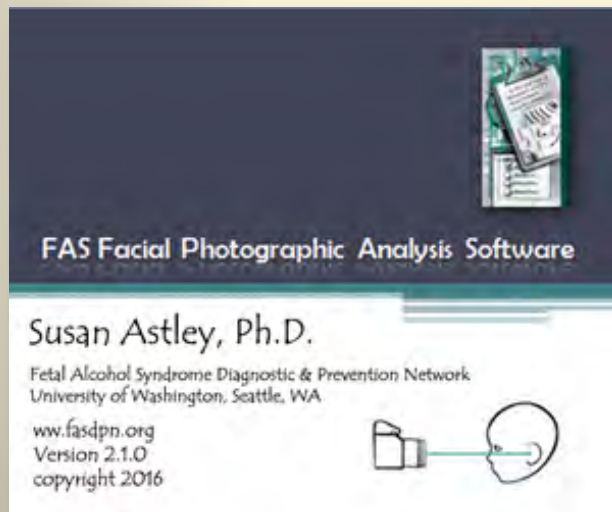


Contact astley@uw.edu

FAS Facial Analysis Software

Available from:

<http://depts.washington.edu/fasdpn/htmls/face-software.htm>



10-Year Foster Care FAS Screening using 2D Photos

10-Year Photo screening confirmed the Rank 4 FAS face is HIGHLY specific.

- > 95% of children with Rank 4 FAS face had FAS.
- 1 out of every 100 children in foster care had FAS.

(2,500 foster children screened over 10 years with 98% participation rate.)



Astley SJ et al Application of the fetal alcohol syndrome facial photographic screening tool in a foster care population. *Journal of Pediatrics*, 2002;141(5):712-7.

The cover of the FAS Facial Photographic Analysis Software manual. It features a dark blue background with a white and green graphic of a clipboard and checklist. The text on the cover includes:

FAS Facial Photographic Analysis Software

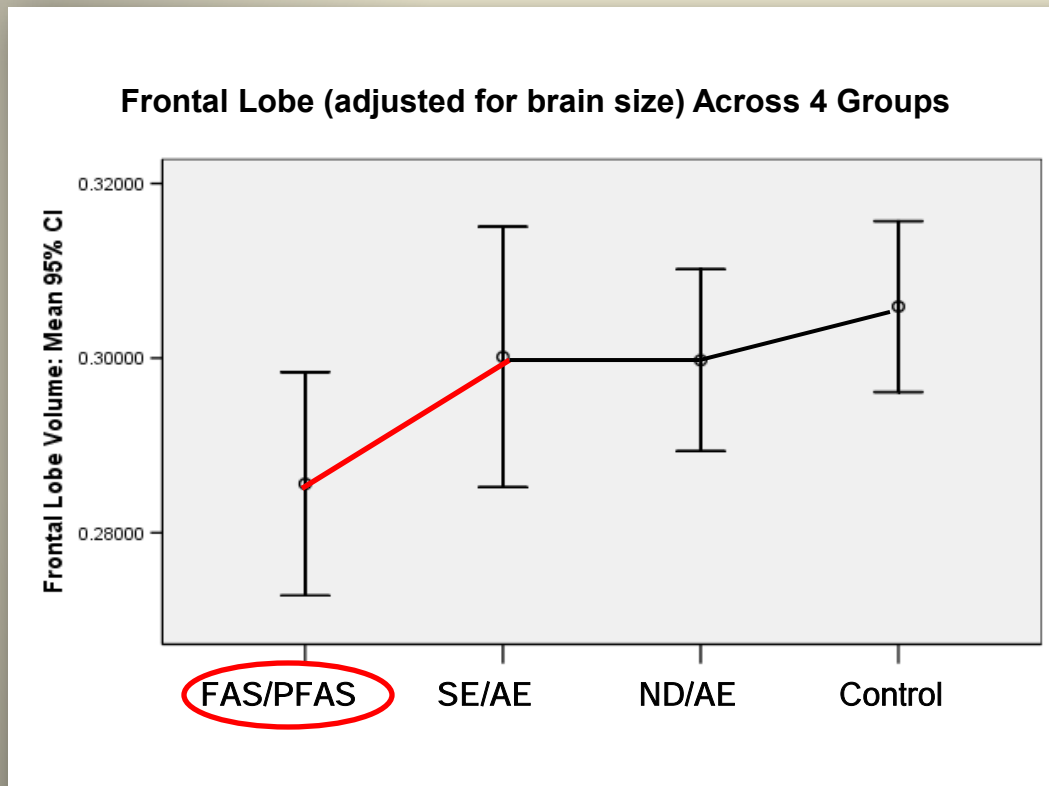
Susan Astley, Ph.D.

Fetal Alcohol Syndrome Diagnostic & Prevention Network
University of Washington, Seattle, WA

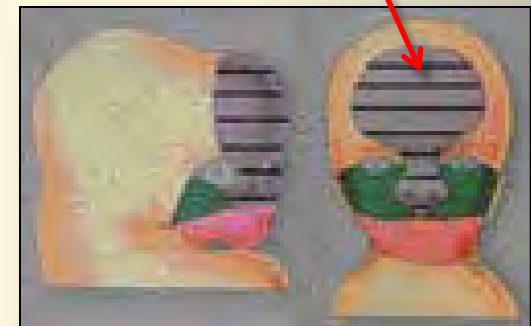
www.fasdph.org
Version 2.0.0
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A diagram of a human head in profile, facing right, with a blue line indicating the lip-philtrum area.

Only those with the Rank 4 FAS Face have Disproportionately Smaller Frontal Lobe Volumes



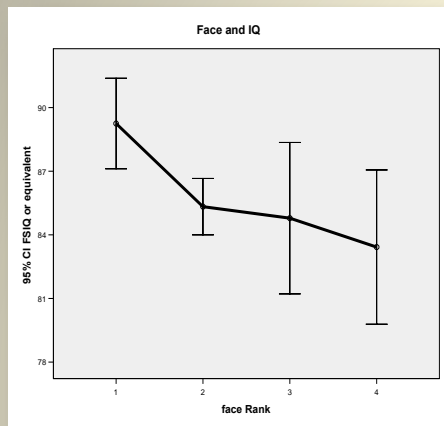
This is particularly compelling since the morphogenesis of the middle and upper face is heavily influenced by signals emanating from the forebrain to the frontonasal prominence



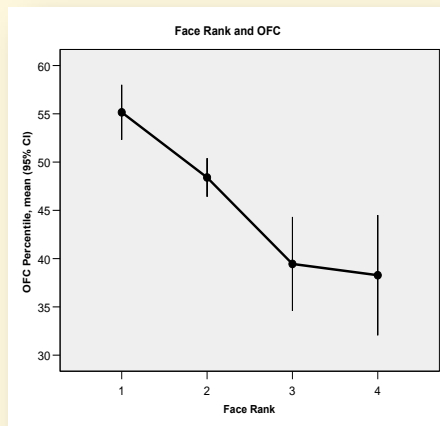
Astley SJ, et al. Magnetic resonance imaging outcomes from a comprehensive magnetic resonance study of children with fetal alcohol spectrum disorders. *Alcoholism: Clin Exp Res.* 2009;33(10):1-19.

The more severe the 4-Digit Code FAS face, the more severe the abnormalities in brain structure, function, even development

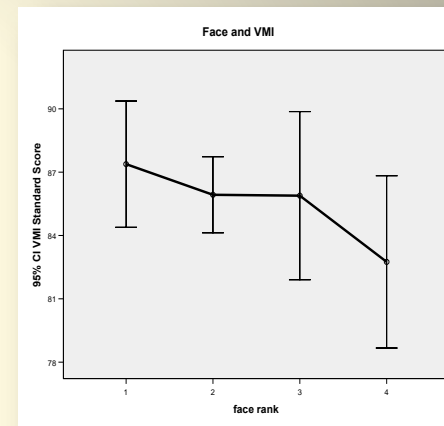
The more severe the FAS face....



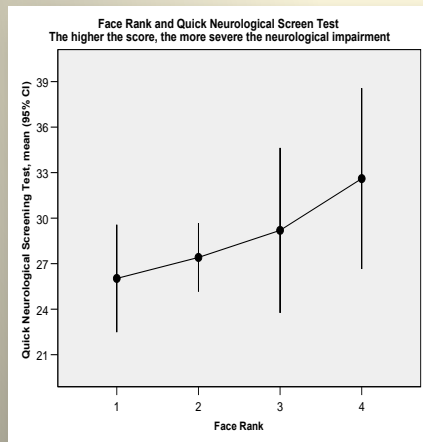
the lower the IQ



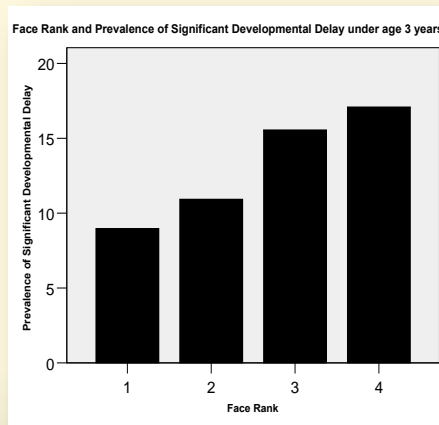
the smaller the OFC



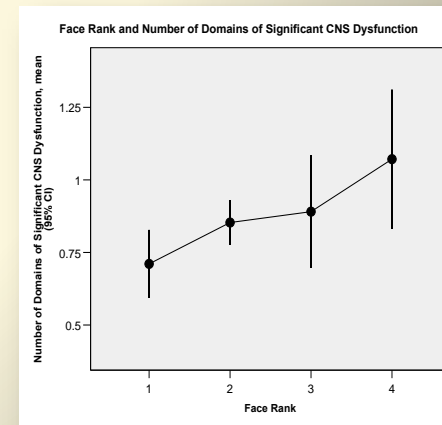
the greater the impairment in visual motor integration



the greater the neurological impairment



the higher the prevalence of developmental delay under age 3



the more domains of significant dysfunction

Does Intervention Work?

YES !

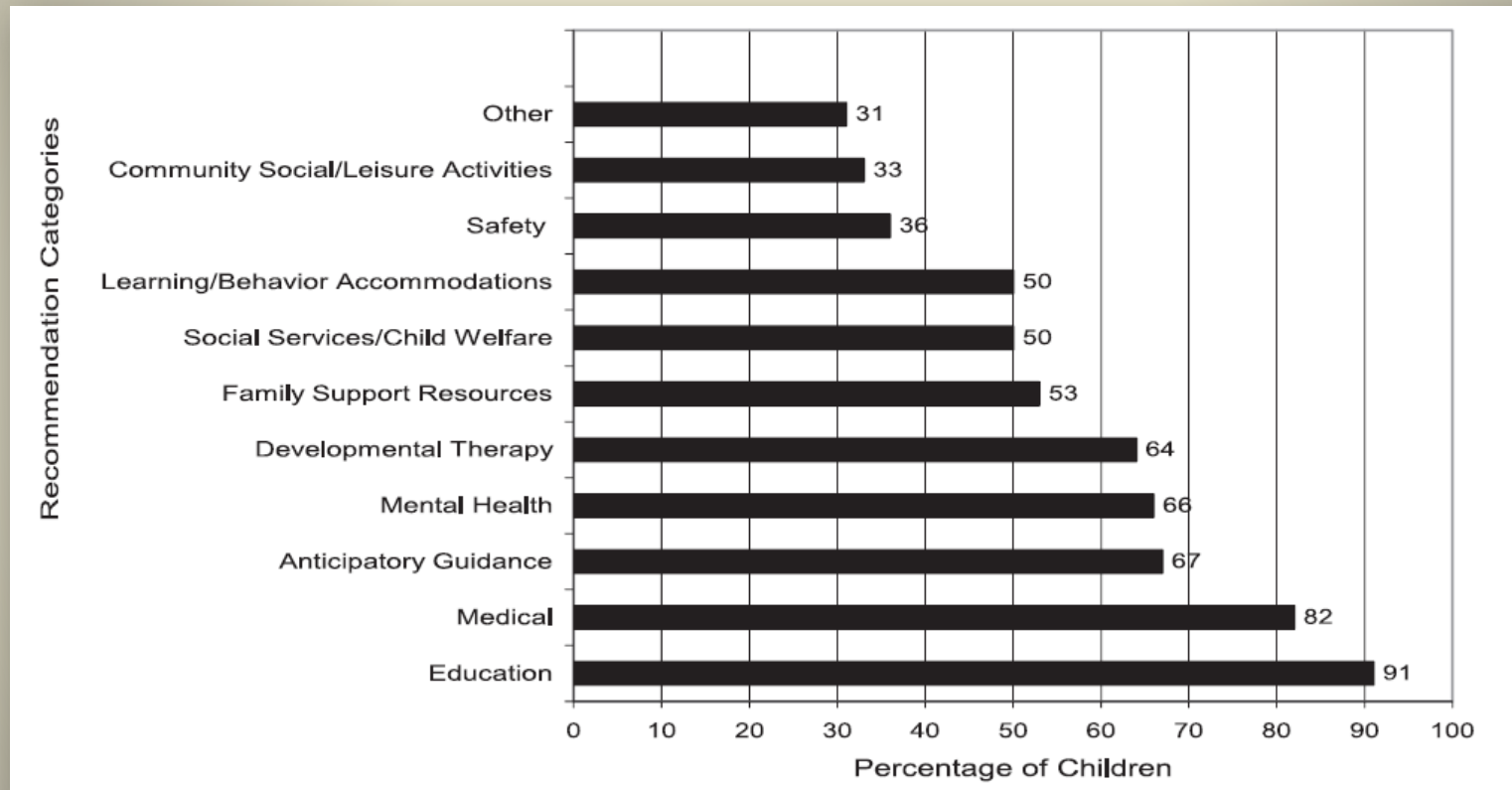
The two factors that predicted the best outcomes in children with prenatal alcohol exposure are:

1. Early diagnosis and intervention
2. A stable, nurturing home environment

Astley SJ. Profile of the first 1,400 patients receiving diagnostic evaluations for fetal alcohol spectrum disorder at the Washington State Fetal Alcohol Syndrome Diagnostic & Prevention Network. *Canadian Journal of Clinical Pharmacology*, Vol 17 (1) Winter 2010:e132-e164:March 26, 2010.

Types of Intervention Recommendations

120 children with FASD (0-16 years of age)



Jirikowic T, Gelo J, Astley S. Children and youth with fetal alcohol spectrum disorders: Summary of intervention recommendations after clinical diagnosis. *Intellectual and Developmental Disabilities* 2010;48(5):330-344.

Patient Satisfaction (2,600 patients)

Would recommend clinic to other families	100 %
Received information they were unable to obtain elsewhere	92 %
Found explanation of 4-Digit Code easy to understand.	86 %
Were somewhat to very successful in finding recommended interventions	90 %
Reported these services met some to all of their needs.	96 %


Astley SJ. Twenty years of patient surveys confirm a FASD 4-Digit-Code interdisciplinary diagnosis afforded substantial access to interventions that met patients' needs. *J Popul Ther Clin Pharmacol* Vol 21 (1):e81-e105; March 6, 2014.

Can FASD be Prevented?

YES !

In Washington State from 1993-1998:

The prevalence of drinking during pregnancy dropped from 15%  4%

The prevalence of FAS births dropped from 7%  2%

Astley SJ. Fetal alcohol syndrome prevention in Washington State: Evidence of success. Paediatric and Perinatal Epidemiology, 2004;18:344-351.

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16. Astley SJ, Stachowiak J, Clarren SK, Clausen C. Application of the fetal alcohol syndrome facial photographic screening tool in a foster care population. *Journal of Pediatrics*, 2002;141(5):712-7.
17. Astley SJ. Fetal alcohol syndrome prevention in Washington State: Evidence of success. *Paediatric and Perinatal Epidemiology*, 2004;18:344-351.
18. Jirikowic T, Gelo J, Astley S Children and youth with fetal alcohol spectrum disorders: Summary of intervention recommendations after clinical diagnosis. *Intellectual and Developm Disabilities* 2010;48(5):330-344.

All literature referenced in this presentation is available at: www.fasdpn.org/htmls/literature.htm

University of Washington FASDPN Website

fasdpn.org



FAS Diagnostic & Prevention Network

FAS DPN: established 1993
Center on Human Development & Disability
University of Washington, Seattle WA

- Table of Contents
- What is the FAS DPN ?
- Screening
- Diagnosis & Tools
- Surveillance
- Intervention
- Prevention
- Training
- Research
- Literature
- Links
- Order Form
- Russia
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FASD Diagnostic Appointments

Legislative Fact Sheet

Interact with FASDPN Tableau Dashboards

VALIDATION of the FASD 4-Digit Code

- Free Lip-Philtrum Guides with 3/4 views for iPhone/Tablet
- (2017) Comparison of 4-Digit Code & Hoyme Diag Systems
- (2016) Growth deficiency essential in FASD Diagnosis
- (2016) Updated FAS Facial Analysis Software
- Video introduction to FAS Facial Photo Analysis Software
- (2015) AAP recognizes FASDPN as national/international leader
- (2014) FASD Recommendations to WA Legislature
- (2014) Astley testimony to WA Legislature on FASD
- (2014) Value of a FASD Diagnosis: 20 yrs of Parent Surveys
- (2013) Validation of the FASD 4-Digit Code
- (2010) Profile of 1,400 WA FAS DPN Patients with FASD
- When is a philtrum Rank 4 or Rank 5?
- Animated Facial Photography and Measurement Instruction
- (2004) 4-Digit Diagnostic Code
- FASD Prevention: Evidence of Success
- 4-Digit Code Online Course (over 1000 graduates)
- Palpebral fissure length measurement accuracy.
- PFL Z-score Calculator & Which Norms to Use

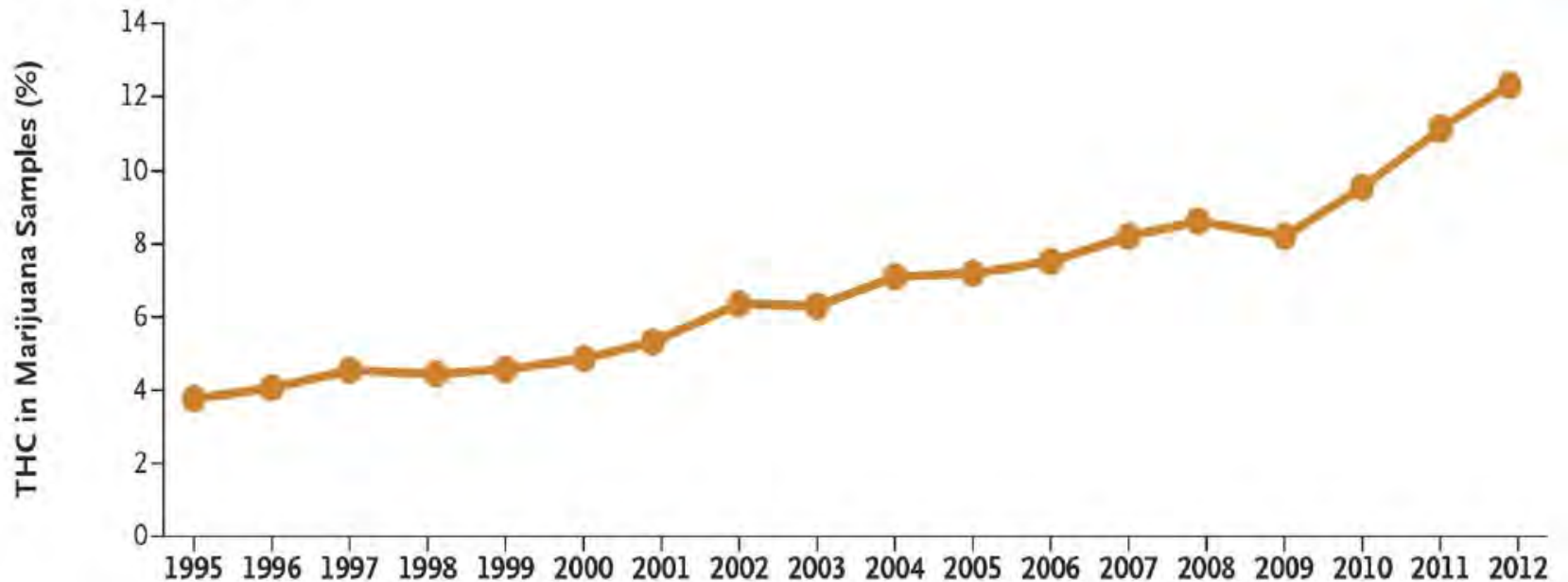


Interact with our new FASDPN
Tableau Dashboards

<http://depts.washington.edu/fasdpn/htmls/Tableau-FASDPN.htm>

Rising Potency of THC

A Potency of THC

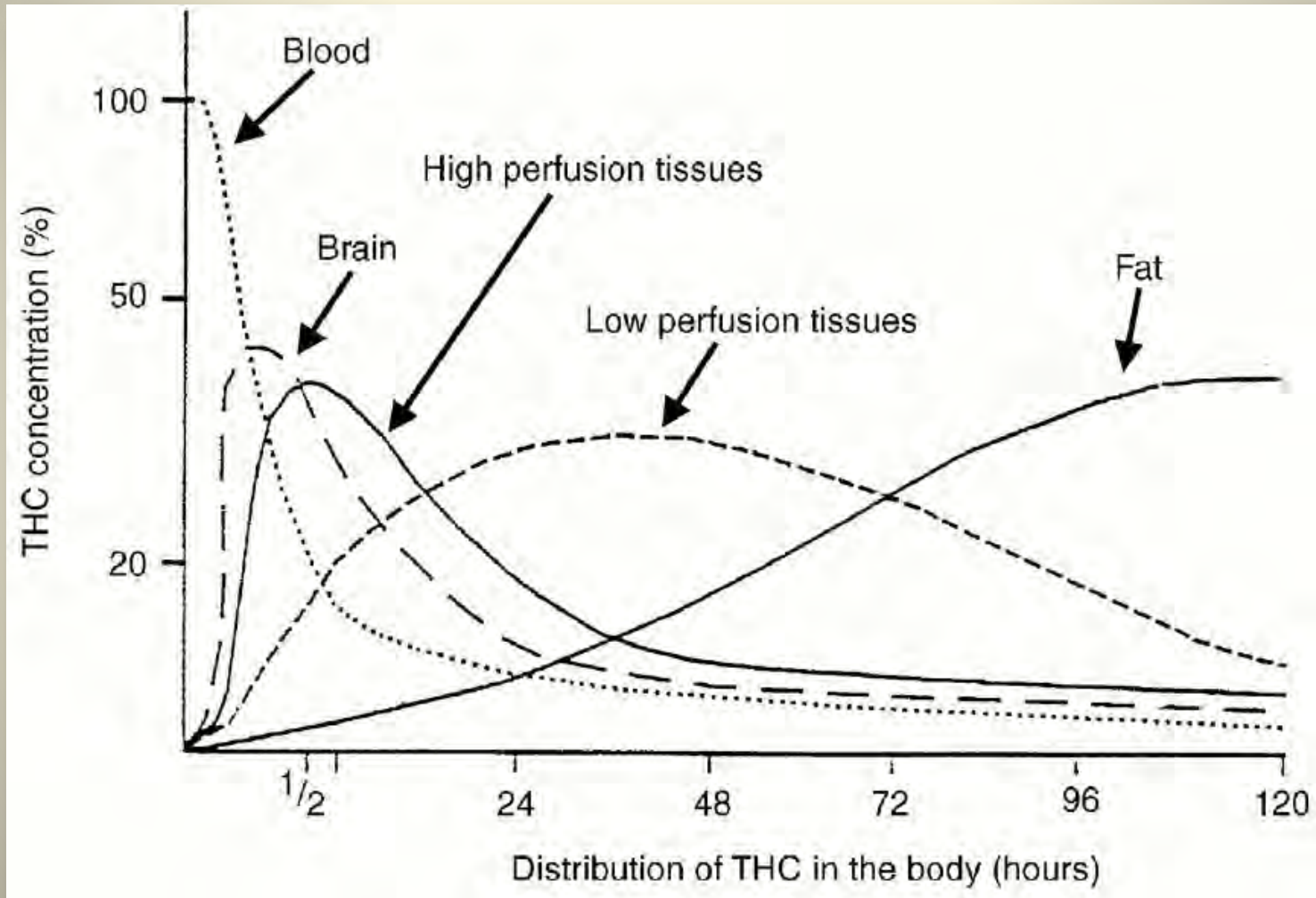


Marijuana Risks

Marijuana is a drug that is associated with substantial risks. Though it comes from a plant and is found in nature, it is not safe for children.

- Crosses the blood-brain barrier
- Is found in significant quantities in breastmilk
- Is lipophilic and stored in fat for weeks to months
- Has motor and neuro-behavior developmental effects on exposed children

Distribution of THC in the body



THC in Human Milk

TCH found in breast milk in concentrations as high as 8-fold that of maternal serum (60 ng/ml vs 7 ng/ml)

Maternal Marijuana Use During Lactation and Infant Development at One Year

SUSAN J. ASTLEY*¹ AND RUTH E. LITTLE†

**Department of Pediatrics, University of Washington, Seattle, WA 98195*

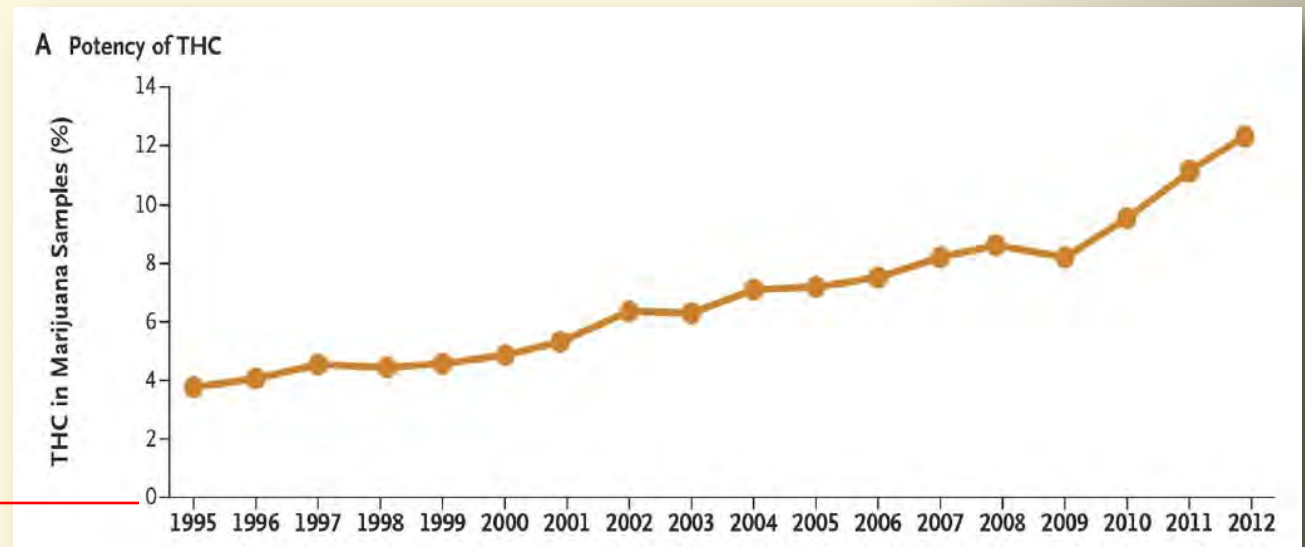
†Department of Epidemiology, University of Michigan, Ann Arbor, MI 48109

Received 25 May 1989

ASTLEY, S. J. AND R. E. LITTLE. *Maternal marijuana use during lactation and infant development at one year.* NEUROTOXICOL TERATOL 12(2) 161-168, 1990.—Prenatal marijuana exposure is associated with adverse perinatal effects. Very little is known about the effect of postnatal marijuana exposure on infant development. Postnatal exposure can result from maternal use of marijuana during lactation. Delta-9-tetrahydrocannabinol (THC) transfers and concentrates in the mother's milk and is absorbed and metabolized by the nursing infant. The present study investigated the relationship between infant exposure to marijuana via the mother's milk and infant motor and mental development at one year of age. One hundred and thirty-six breast-fed infants were assessed at one year of age for motor and mental development. Sixty-eight infants were exposed to marijuana via the mother's milk. An additional 68 infants were matched to the marijuana-exposed infants on pre- and postpartum maternal alcohol and tobacco use. Marijuana exposure via the mother's milk during the first month postpartum appeared to be associated with a decrease in infant motor development at one year of age.

Daily infant exposure to marijuana via the mother's milk during postpartum month 1 was associated with a 14-point (1 SD) decrease in the Bayley index of infant motor development.

Rising Potency of THC



1985



Potency was much lower in our 1985 study

AAP Published Guidelines on Breastfeeding and Marijuana

Street drugs such as PCP, cocaine and cannabis can be detected in human milk, and their use by breastfeeding mothers is of concern, particularly with regard to the infant's long-term neurobehavioral development, and thus are contraindicated.