



United States Drug Testing Laboratories, Inc.  
1700 S. Mount Prospect Road | Des Plaines, IL | 60018  
Main: 847-375-0770 | [www.usdtl.com](http://www.usdtl.com) | Fax: 847-375-0775

# **Newborn Phosphatidylethanol Screening to Detect Fetal Alcohol Exposure in Uruguay**

Aileen Baldwin, Ph.D., MPH  
8th International Conference on FASD



# Disclosure

- I am not discussing any commercial products or services
- I have no financial interests herein
- I am in compliance with HIPAA in this presentation

# Objectives

- Identifying infants or children at risk for developing FASD often relies on confirmation of maternal drinking during pregnancy or detection of prenatal alcohol exposure in the newborn.
- Prenatal records can often lack information on alcohol use.
- In certain situations, maternal self-report can be unreliable due to recall bias or apprehension of stigmatization associated with drinking during pregnancy.
- Biomarkers of alcohol use and/or alcohol exposure can help in identifying at-risk mothers and also newborns who have been exposed to alcohol in utero.
- Phosphatidylethanol is a highly sensitive biomarker of alcohol use but the clinical utility of PEth as a screening test for prenatal alcohol exposure in newborns has not been examined.

# Uruguay





- Cultural patterns of drinking alcohol in Uruguay have changed in the last 30 years, from moderate consumption with meals to more risky patterns of heavy alcohol consumption.
- Drinking during pregnancy is common in Uruguay, in part due to a lack of information given to pregnant women about possible alcohol-related risks from drinking during pregnancy.
- National surveys do not assess alcohol consumption during pregnancy in Uruguay, although recent epidemiological studies have demonstrated that it is a significant problem.



# Studies of Alcohol Use during Pregnancy

- In a 2005 study of 900 women surveyed from two public healthcare hospitals in Montevideo following delivery, 36.8% of the mothers reported alcohol consumption at some point during their pregnancy.
- A subsequent study in 2007 found very high rates of reported alcohol consumption (65.6%) in an urban population of young, incompletely educated women from low socioeconomic status delivering in the public healthcare hospitals in Montevideo.
- The incidence of prenatal alcohol exposure, as determined by fatty acid ethyl esters (FAEE) detection in meconium, was found to be 44%.

# Study Rationale



- No study to date has examined neurocognitive profiles and facial dysmorphology in a cohort of infants with known alcohol exposure measured in mothers and newborns using a direct alcohol biomarker at birth.

Design

Within 48 Hours  
of Birth

- Hospital General de las Fuerzas Armadas in Montevideo, Uruguay
- Maternal Interview 696 mother/newborn pairs
- Mother and baby blood samples for PEth analysis

Six Months

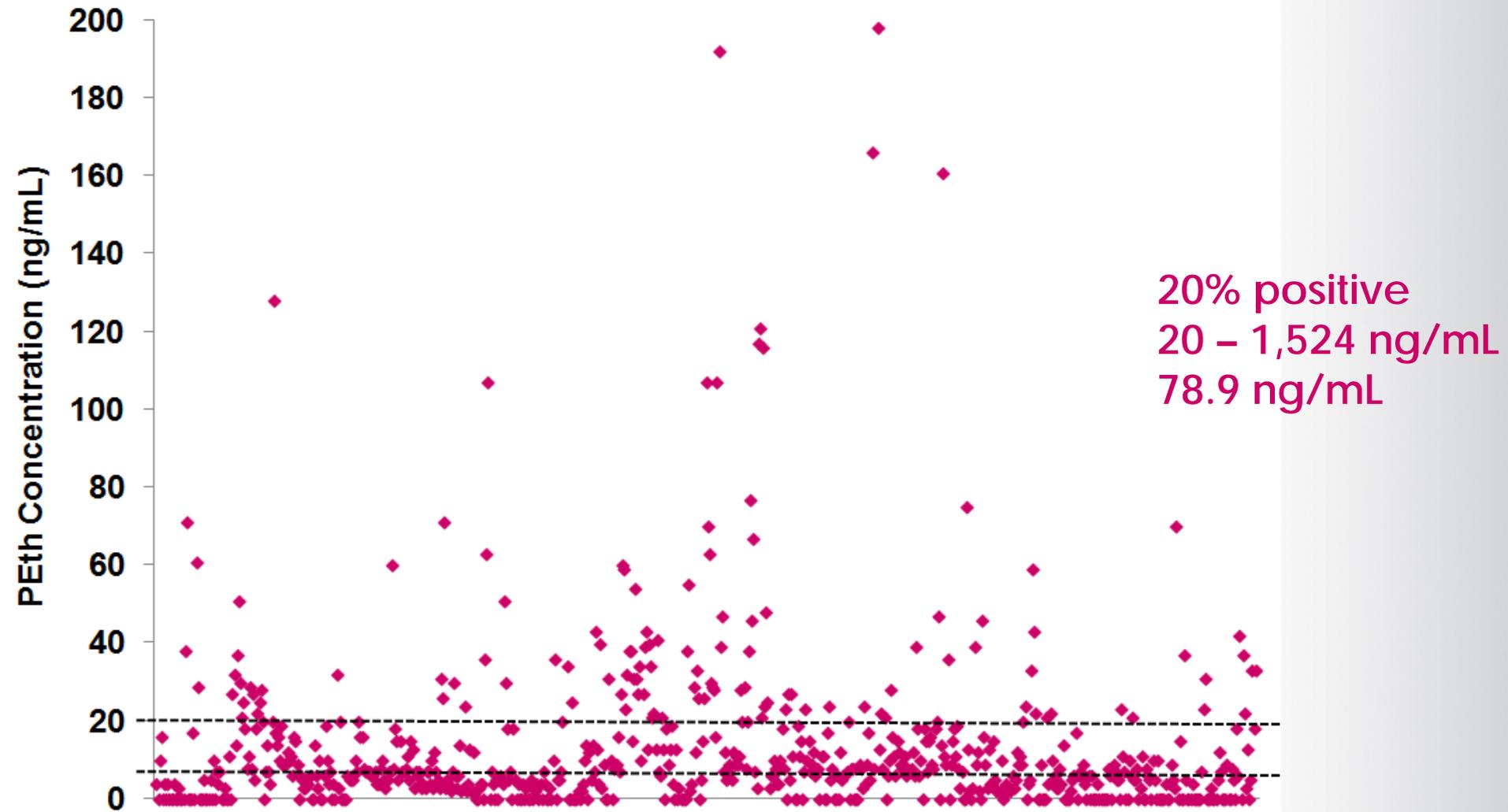
- 41 infants enrolled in follow-up pilot study
- Dysmorphology Checklist
- Bayley Scales of Infant Development
- Vineland Adaptive Behavior

Nine months to  
One year

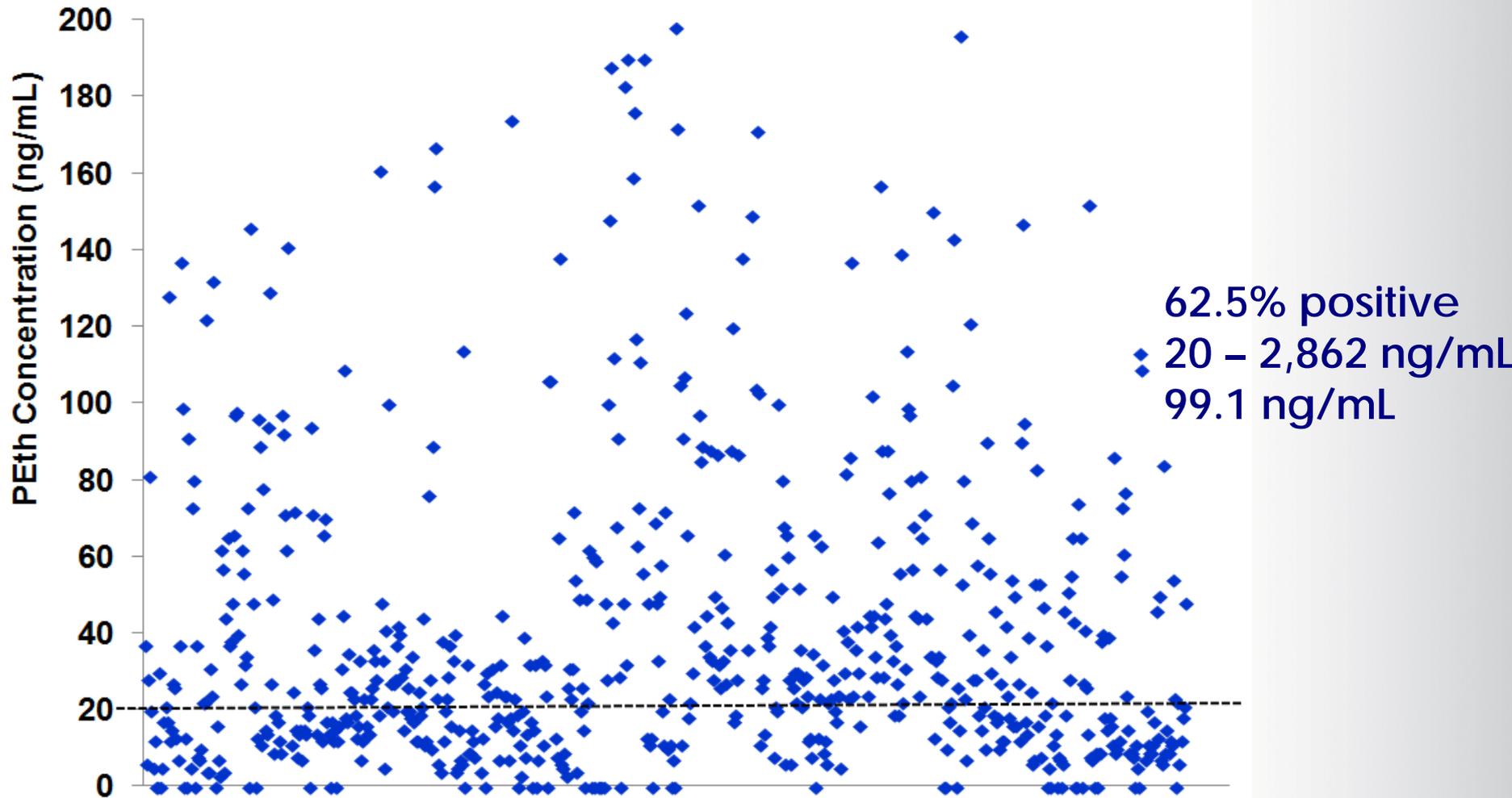
- Dysmorphology Checklist
- Bayley Scales of Infant Development
- Vineland Adaptive Behavior

# Biomarker Results

# Prevalence of PEth in all enrolled mothers



# Prevalence of PEth in all enrolled newborns



# Follow Up Study Results

# Sample Characteristics in Follow Up Pilot Study (N=41)

## Age

Range: 19-40 years

M=27.96 (5.57)



White=46.3%

Black=7.3%

Mixed= 41.5%

Native Uruguayan= 4.9%

Married= 36.6%

Unmarried, partnered= 56.1%

Single =4.9%

Divorced/Separated= 2.4%

## Education

M=10.95 (3.34)

Range= 3-21 years



# Substance Use During Pregnancy



7.3% at any point in pregnancy  
4.9% last 30 days



0% cocaine or marijuana use

# Alcohol Use During Pregnancy

## Self-Report

First Trimester= 25%

Second Trimester= 4.9%

Last Trimester= 9.8%

Any point in pregnancy = 26.8%



## Maternal PEth

Positive =29.3%

Negative= 56.1%

Missing= 14.6%

Average PEth= 34.58ng/mL

Range= 8 -128 ng/mL

# Maternal Risk Factors for Alcohol Consuming and Abstaining Women

Difference in Risk Factors by Maternal PEth Result

	Positive Maternal PEth M (SD)	Negative Maternal PEth M (SD)	t	t-test df	p
Age (years)	29.84 (5.20)	27.36 (5.94)	-1.12	33	0.293
Education (years)	11.67 (2.74)	10.95 (3.5)	0.605	30	0.55
Gavidity	3.0 (1.6)	2.09 (1.13)	-1.97	33	0.057
Age at first drink (years)	14.78 (4.46)	16.18 (3.16)	1.07	32	0.292
Heel PEth (ng/mL)	110.0 (92.56)	24.85 (11.62)	-3.16	11.32	0.009
Cord PEth (ng/mL)	79.67 (109.94)	37.93 (23.71)	-1.38	21	0.18

# Birth Data

Gestational Age  
M = 38.78 weeks

Assigned Sex at Birth  
Female = 56.1%  
Male = 43.9%

Apgar  
1 min: M= 8.82  
(0.61)  
5 min: M= 9.92  
(0.36)



Birth Weight  
M= 3295.56g (579.89g)  
Range= 1195-4330g

Birth Length  
M= 48.84cm (2.18)  
Range= 43-54cm

Head  
Circumference  
M= 34.61cm (1.22)  
Range= 32-37

# Infant Biomarker Results

## Umbilical Cord Blood PEth

Positive= 63.4%  
Negative= 9.8%  
Missing= 26.8%



Mean Positive PEth= 54.9ng/mL

Range= 13 - 367ng/mL

## Heel Stick Blood PEth

Positive= 65.9%  
Negative= 14.6%  
Missing= 19.5%

Mean Positive PEth= 61.8 ng/mL

Range= 8 - 281ng/mL

# Infants Meeting FASD Criteria



Infant	Timepoint		Positive for Alcohol Use				Height ≤ 10%	Weight ≤ 10%	Head Circumference ≤ 10%	Dysmorphology PFL ≤ 10%	Other Significant Dysmorphology	Vermilion Code 4 or 5	Philtrum Code 4 or 5	Bayley ≤ 25%			Vineland ≤ 25%		Diagnosis		
	1	2	Heel PEth	Cord PEth	Maternal PEth	Self-Report								Cognitive	Language	Motor	Communication	Daily Living Skills	Socialization	Motor	ABC
6001	X	X	40	X	X																
6002	X	X	26	X																	
6003	X	X	23																		
6008	X	X	10																		X
6009	X	X	137																		X
6012	X	X	62	X	X	X															X
6014	X	X	14	X	X																
6015	X	X	14	X	X																
6016	X	X	129	X	X																
6018	X	X	15	X																	
6020	X	X	45	X																	
6021	X	X	19		X																
6022	X	X	23	X	X	X															X
6024	X	X	14	X																	
6025	X	X	28	X																	
6027	X	X	42	X		X															X
6033	X	X	167	X	X	X															X
6038	X	X	0																		
6039	X	X	15		X																
6040	X	X	281	X	X																
6041	X	X	207	X	X																
6044	X	X	X																		
6047	X	X	15	X																	
6053	X	X	174	X																	

✓24 infants met the criteria for any FASD diagnosis at either 6 months or 1 year.

✓At the first follow-up 17 children met the diagnostic criteria, with the most common diagnosis being ARND in 16 of the infants.

✓At the second follow-up there were 15 children that met criteria for an diagnosis with ARND again being the most common diagnosis in 12 of the children.

✓No child met the criteria for FAS at either time point.

✓Of the 24 children that met the criteria for an FASD diagnosis at either time point, only 2 children did not have confirmed alcohol exposure during pregnancy based on PEth at birth or maternal self-report.

✓The average PEth concentration at birth in newborns who met the criteria for an FASD diagnosis was 65.2 ng/ml.

Infants Not Meeting FASD Criteria

Infant	Timepoint		Positive for Alcohol Use				Dysmorphology				Bayley ≤ 25%			Vineland ≤ 25%				Diagnosis							
	1	2	Heel PEth	Cord PEth	Maternal PEth	Self-Report	Height ≤ 10%	Weight ≤ 10%	Head Circumference ≤ 10%	PFL ≤ 10%	Other Significant Dysmorphology	Vermilion Code 4 or 5	Philtrum Code 4 or 5	Cognitive	Language	Motor	Communication	Daily Living Skills	Socialization	Motor	ABC	FAS	PFAS	ARND	None
6004	X	X	12											X			X			X	X				X
6005	X	X	8	X		X								X	X										X
6006	X	X	22	X		X	X		X	X				X	X										X
6010	X	X					X							X	X	X									X
6013	X	X	27				X																		X
6017	X	X	21	X	X	X			X						X										X
6023	X	X	7	X			X																		X
6028	X	X	37						X																X
6031	X	X	25	X					X																X
6032	X	X					X		X	X				X	X	X		X		X					X
6034	X	X	157	X	X				X	X															X
6035	X	X	157	X	X		X			X															X
6036	X	X	29	X		X			X																X
6037	X	X	6											X											X
6048	X	X	24	X					X	X															X
6049	X	X	24	X			X	X	X	X															X
6050	X	X	7							X															X

- ✓ 17 children did not meet the criteria for an FASD diagnosis at 6 months or 1 year time points.
- ✓ Only 3 of the mothers had a positive PEth at the time of birth, compared to 11 of the mothers who had a child that did meet the criteria for an FASD.
- ✓ The average PEth concentration at birth in newborns who did not meet the criteria for an FASD diagnosis was 37.5 ng/ml.

# Discussion and Conclusions

- These findings suggest that the prevalence of alcohol consumption during pregnancy continues to be a serious public health problem in Uruguay.
- These findings also suggest that biomarker screening can assist in early infancy developmental and dysmorphology testing to screen for FASD.
- Early identification is key for early intervention, and newborn PEth screening could assist in identify prenatal alcohol exposure.

# Acknowledgements

## USDTL Laboratory

Douglas Lewis

Joseph Jones

Veronica Lewis

Adam Negrusz

Mary Jones

## Northwestern University

Dr. Michael Fleming

Erika Ostrander

Nicole Hayes

Matthew Smith

## Uruguay

Dr. Raquel Magri

Monica Martinez

Patricia Fisher

Patricia Martinez

NIAAA Grant

U01 AA023176

