Linkage of PRAMS and Alaska Birth Defects Registry to describe alcohol- and tobacco-related birth defects

Jonathan Bressler, MPH

Alaska Department of Health and Social Services
CSTE Applied Epidemiology Fellowship Program
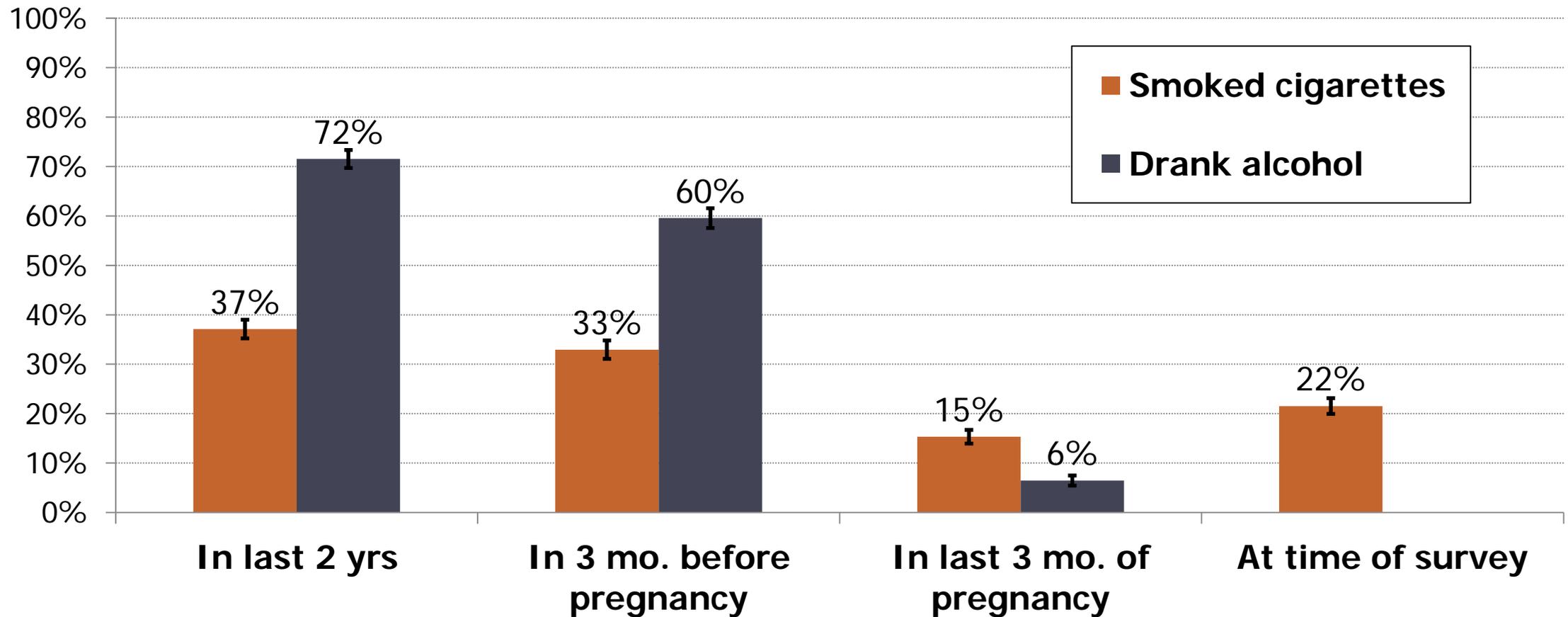
Agenda

Objectives

- Link ABDR and PRAMS
  - To conduct surveillance and monitor correlations between maternal experiences and birth defects

- Explore environmental exposures during pregnancy
  - Focus on smoking and alcohol use

- Correlations are exploratory and do not imply causation

Data sources

- **Alaska Birth Defects Registry (ABDR)**
  - Passive surveillance system: tracks birth defects in Alaska
  - Facilities report ICD codes
  - May be reported within first six years of child's life

- **Pregnancy Risk Assessment Monitoring System (PRAMS)**
  - Population-based survey of women who gave birth
  - Maternal behaviors and experiences during pregnancy
  - Oversamples low birth weight children

Alaska PRAMS smoking and drinking estimates, 2009-2011

Bar chart legend: Smoked cigarettes (orange), Drank alcohol (dark gray/navy).

Category	Smoked cigarettes	Drank alcohol
In last 2 yrs	37%	72%
In 3 mo. before pregnancy	33%	60%
In last 3 mo. of pregnancy	15%	6%
At time of survey	22%	

Linkage

- Used Phase 6 PRAMS surveys
  - Date of birth 2009 to 2011

- ABDR reports up to 2014
  - For 2011 births, includes first three years of life
    - About 85% of birth defects are reported within first three years
  - A child can have multiple birth defects

- Linked on birth certificate number, and de-identified

Linkage
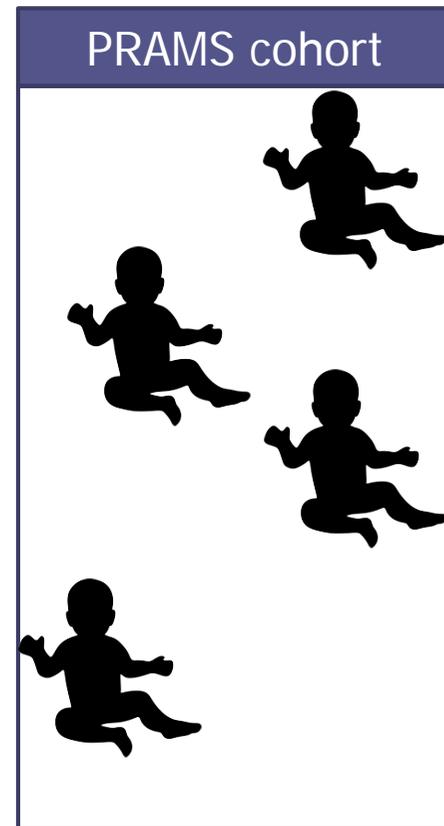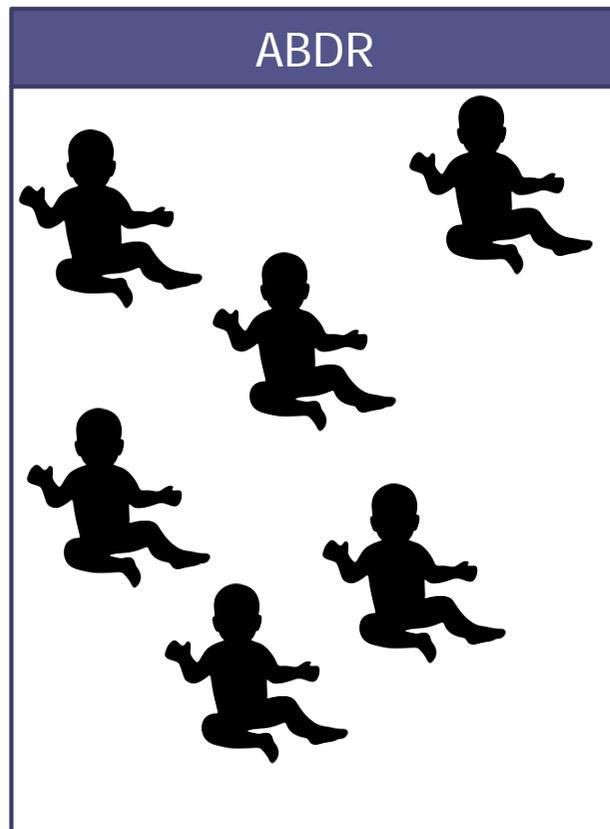
ABDR

PRAMS cohort

Linkage
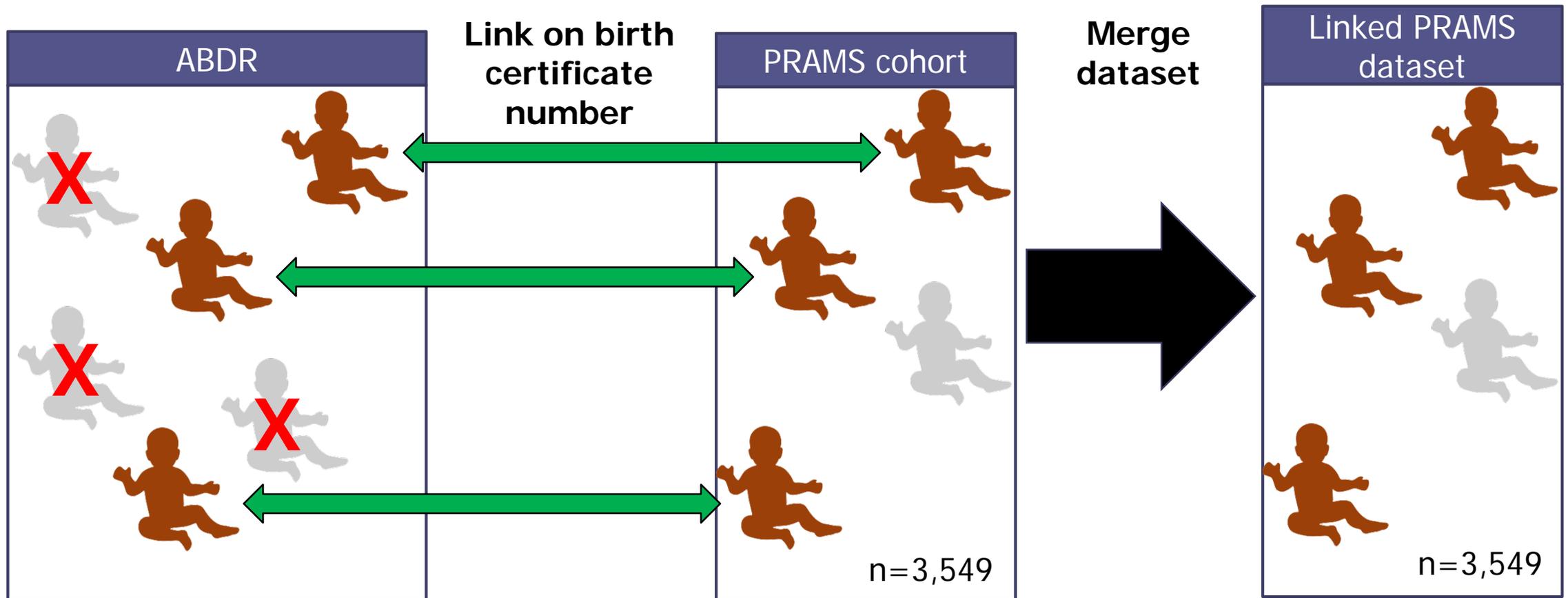
Estimates

1. Validation: birth defect prevalence
   - Estimated prevalence from PRAMS sample using PRAMS weighting
   - Compared estimates to reported prevalence in ABDR

2. Correlations of smoking & drinking with certain birth defects
   - Fetal alcohol spectrum (FAS) not included
   - Little scientific evidence for causation: linkage was exploratory

Birth defect groupings: Prevalence estimates per 10,000 births

Grouping	PRAMS (n=3,549)			
	Sample count	Count estimate	Prevalence estimate	95% CI
Cardiovascular	177			
Chromosomal	16			
CNS	12			
Eye	0			
Ear	10			
Gastrointestinal	11			
Genitourinary	42			
Males	39			
Females	<6			
Musculoskeletal	40			
Orofacial	13			

Birth defect groupings: Prevalence estimates per 10,000 births

Grouping	PRAMS (n=3,549)			
	Sample count	Count estimate	Prevalence estimate	95% CI
Cardiovascular	177	793	237	183–291
Chromosomal	16	60	18	0–36
CNS	12	81	24	6–43
Eye	0	0	0	
Ear	10	91	27	7–47
Gastrointestinal	11	62	18	4–33
Genitourinary	42	270	81	48–114
Males	39	265	154	90–218
Females	<6	<6	3	1–5
Musculoskeletal	40	232	69	41–98
Orofacial	13	122	37	13–60

Introduction | Methods | Results | Conclusions | Limitations | Strengths | Next steps

Birth defect groupings: Prevalence estimates per 10,000 births

Grouping	PRAMS (n=3,549)				ABDR (N=33,920)	
	Sample count	Count estimate	Prevalence estimate	95% CI	Reported count	Reported prevalence
Cardiovascular	177	793	237	183–291	838	247
Chromosomal	16	60	18	0–36	100	29
CNS	12	81	24	6–43	58	17
Eye	0	0	0		17	5
Ear	10	91	27	7–47	30	9
Gastrointestinal	11	62	18	4–33	69	20
Genitourinary	42	270	81	48–114	288	85
Males	39	265	154	90–218	268	153
Females	<6	<6	3	1–5	20	12
Musculoskeletal	40	232	69	41–98	227	67
Orofacial	13	122	37	13–60	126	37

Introduction | Methods | Results | Conclusions | Limitations | Strengths | Next steps

Specific conditions examples: Prevalence estimates per 10,000 births

Condition	PRAMS (n=3,549)				ABDR (N=33,920)	
	Sample count	Count estimate	Prevalence estimate	95% CI	Count	Reported prevalence
Atrial septal defect	129	526	157	114–201	548	162
Aortic valve stenosis	<6	<6	0	0–1	9	3
Ventricular septal defect	57	315	94	59–129	346	102
Spina bifida	4	21	6	0–16	25	7
Cleft conditions	12	106	32	10–54	115	34
Trisomy 21 (Downs)	6	15	5	0–9	56	17
Turner's syndrome	<6	37	11	0–29	33	10

Cardio-vascular — Atrial septal defect, Aortic valve stenosis, Ventricular septal defect

CNS — Spina bifida

Orofacial — Cleft conditions

Chromo-somal — Trisomy 21 (Downs), Turner's syndrome

Correlations

- Prevalence estimates adequately represent population for some conditions

- Explored correlations between maternal smoking/alcohol consumption and these conditions
  - Noted cell counts and weighted odds ratios

Correlations: cell counts, weighted odds ratios

Smoked during last 3 mo. of pregnancy

	No	Yes
CARDIO=0	2712	601
CARDIO=1	128	47

OR = 2.66 (1.56–4.40)

Smoked during last 3 mo. of pregnancy

	No	Yes
CNS=0	2831	645
CNS=1	9	<6

OR = 1.53 (0.26–5.87)

Smoked during last 3 mo. of pregnancy

	No	Yes
ORO=0	2831	644
ORO=1	9	<6

OR = 1.60 (0.37–5.09)

Drank in last 3 mo. of pregnancy

	No	Yes
CARDIO=0	3083	200
CARDIO=1	158	14

OR = 0.92 (0.32–2.02)

Drank in last 3 mo. of pregnancy

	No	Yes
CNS=0	3229	214
CNS=1	12	0

OR = 0

Drank in last 3 mo. of pregnancy

	No	Yes
ORO=0	3229	213
ORO=1	12	<6

OR = 3.06 (0.20–17.63)

Correlations: Cardiovascular conditions & smoking

Atrial septal defect

Smoked in last 2 years

	No	Yes
ASD=0	2005	1362
ASD=1	64	65

OR = 2.43 (1.39–4.32)

Smoked in 3 mo. before pregnancy

	No	Yes
ASD=0	5141	1217
ASD=1	70	57

OR = 2.37 (1.35–4.20)

Smoked during last 3 mo. of pregnancy

	No	Yes
ASD=0	2750	609
ASD=1	90	39

OR = 3.41 (1.85–6.11)

Smoked at time of survey

	No	Yes
ASD=0	2524	839
ASD=1	87	42

OR = 2.24 (1.23–3.95)

Ventricular septal defect

Smoked in last 2 years

	No	Yes
VSD=0	2042	1399
VSD=1	27	28

OR = 2.23 (1.03–4.96)

Smoked in 3 mo. before pregnancy

	No	Yes
VSD=0	2183	1249
VSD=1	28	25

OR = 2.08 (0.94–4.59)

Smoked during last 3 mo. of pregnancy

	No	Yes
VSD=0	2801	632
VSD=1	39	16

OR = 2.98 (1.22–6.77)

Smoked at time of survey

	No	Yes
VSD=0	2576	861
VSD=1	35	20

OR = 2.76 (1.23–6.02)

Introduction | Methods | **Results** | Conclusions | Limitations | Strengths | Next steps

Further inquiry…

- Are there fewer defects among children whose mothers were smokers but stopped smoking during pregnancy?

```
                                              ┌─── Smoked during
                                              │    pregnancy (n=639)
                        ┌─── Smoked before ───┤
                        │    pregnancy (n=1,274)
                        │                     └─── Did not smoke during
All PRAMS ──────────────┤                          pregnancy (n=621)
(n=3,549)               │
                        └─── Did not smoke before
                             pregnancy (n=2,211)
```
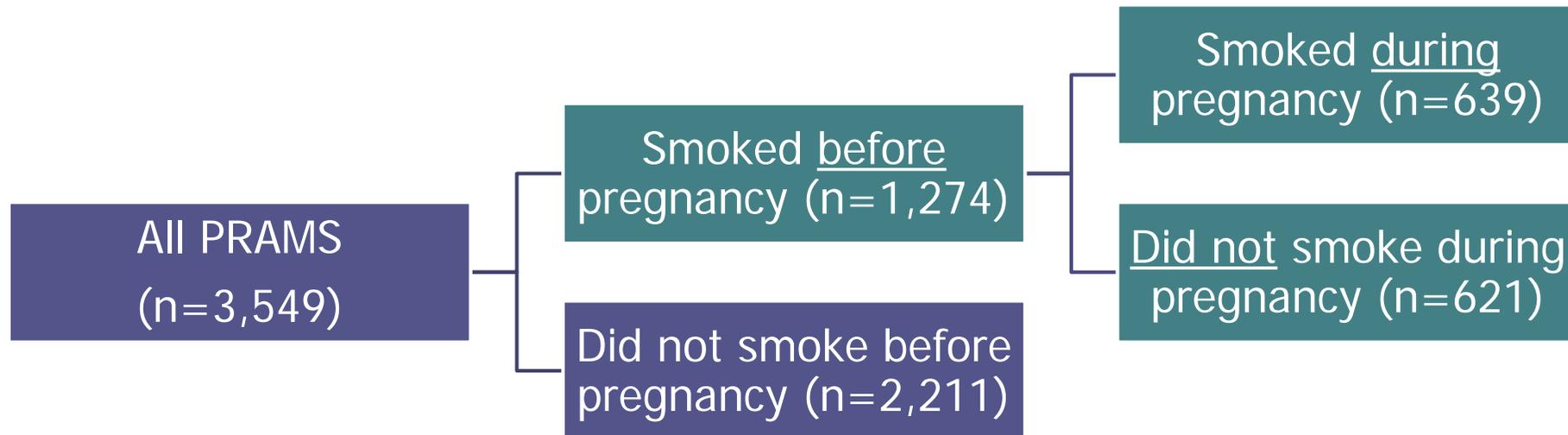
Correlations among women who smoked <u>before</u> pregnancy

Condition	Smoking vs. not smoking during pregnancy (n=1274)	
	OR	95% CI
All cardiovascular defects	1.72	0.84–3.60
Atrial septal defect	2.23	0.94–5.74
Ventricular septal defect	1.72	0.60–5.29

CARDIOVASCULAR

	No	Yes
CARDIO=0	593	593
CARDIO=1	28	46

ASD

	No	Yes
ASD=0	602	601
ASD=1	19	38

VSD

	No	Yes
VSD=0	611	624
VSD=1	10	15

In these examples...

- No nationally reportable non-FAS congenital conditions were correlated with maternal drinking

- Some cardiovascular defects were correlated with smoking during pregnancy

- Although stopping smoking during pregnancy showed no significant reduction of CV defect risk, preliminary findings suggest an effect
  - Further study warranted

Linkage of ABDR & PRAMS

- Linkage of PRAMS with birth defects registry is straightforward
  - Simple to link on birth certificate

- PRAMS survey weighting can be used to estimate the prevalence of some common birth defects
  - Beware of low cell counts/low prevalence

- Correlations between maternal experiences and birth defects can inform hypotheses for further study and intervention

Limitations

- Low cell counts and low prevalence preclude highly specific analyses

- Lack of scientific literature on etiology of many conditions precludes causal inference

- Coding misspecification: Reported prevalence may not reflect true prevalence

Strengths

- Data linkage allows monitoring of correlations between maternal experiences and birth defects

- PRAMS survey accurately represents population

- Linkage can inform interventions and generate hypotheses

Potential next steps

- Explore correlations with other maternal experiences
  - Number of cigarettes
  - Other substance use

- Add other PRAMS phases to linkage to raise sample size

- Improved surveillance
  - Compare reported smoking/drinking on birth certificate to PRAMS responses

- Outreach to reduce substance use during pregnancy

Acknowledgements

- **Alaska Dept. of Health and Social Services**
  - Section of Women's, Children's and Family Health – MCH Epidemiology
    - Jared Parrish, PhD
    - Kit Coleman
  - Section of Epidemiology – Environmental Public Health
    - Sandrine Deglin, PhD

- **Council of State and Territorial Epidemiologists**

Contact: jonathan.bressler@alaska.gov