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COVID-19: Incidence of Preterm Birth During "Stay-at-Home" Orders and Predictors of Pediatric Vaccine Acceptance

43rd Annual L. Joseph Butterfield Perinatal Conference
September 9, 2022

Disclosures

Sunah Hwang, MD, MPH, PhD and Stephanie Bourque, MD, MSCS have nothing to disclose.

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Objectives

- Upon completion of this activity, participants will be able to explain trends in preterm birth rates in Colorado before and after the stay-at-home COVID-19 restriction enactment.
- Upon completion of this activity, participants will be able to explain trends in national pediatric COVID-19 cases and overall vaccination rates.
- Upon completion of this activity, participants will be able to summarize prevalence and predictors of pediatric COVID-19 vaccine acceptance and hesitancy.

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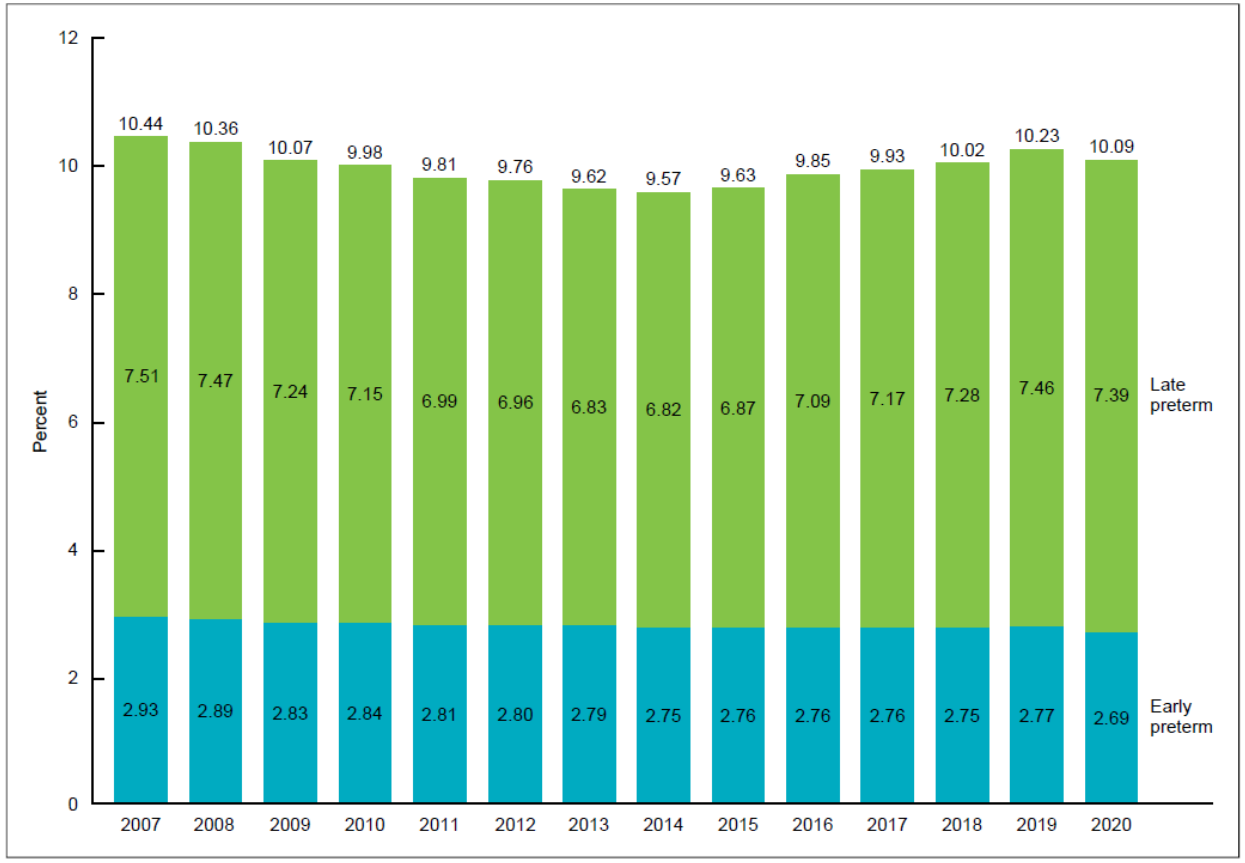
U.S. Preterm Birth Rates, 2007-2020



Hamilton BE, et al. Births: Provisional data for 2020. National Center for Health Statistics. May 2021.

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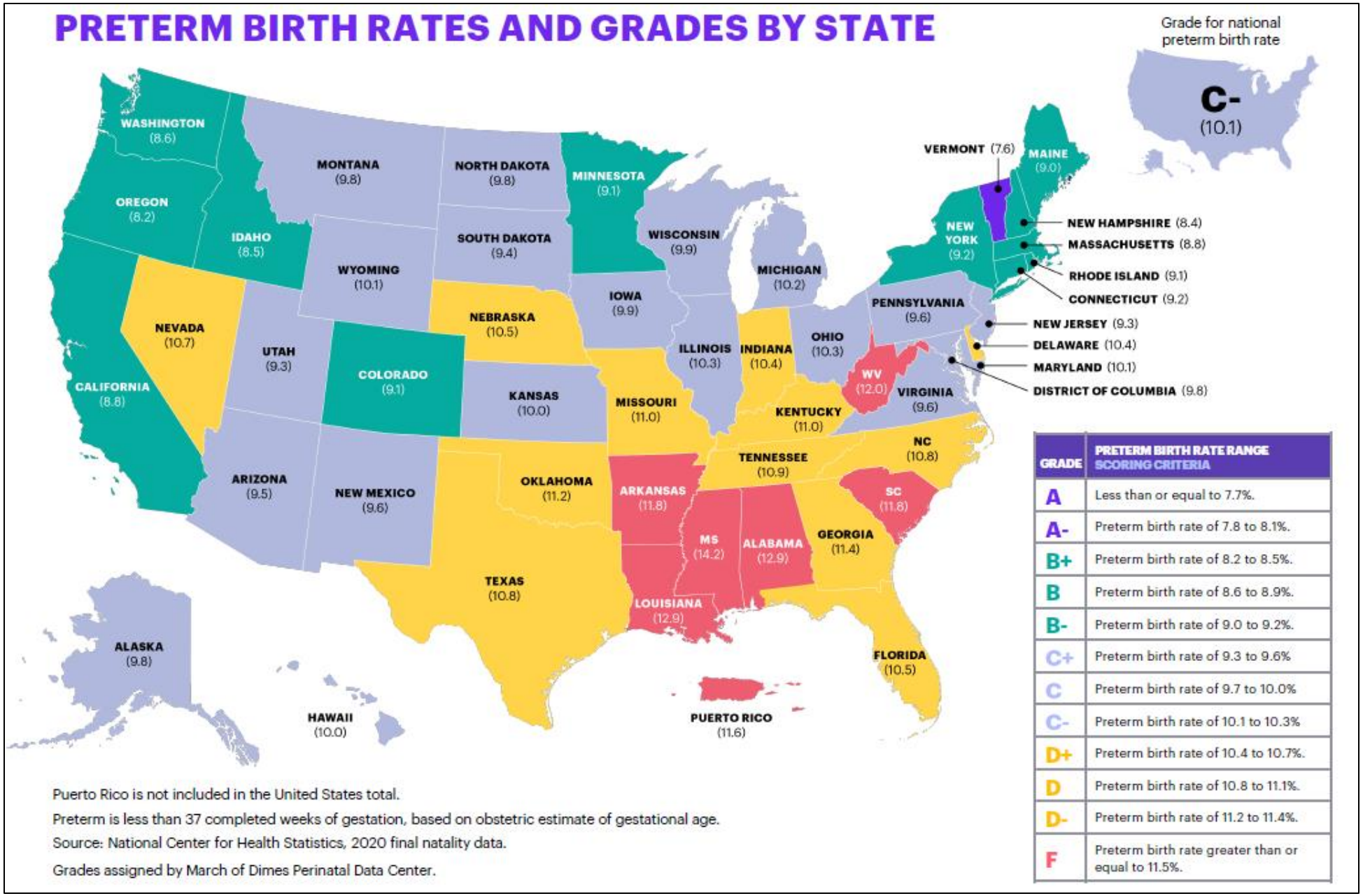
PREMATURE BIRTH RATES AND GRADES BY STATE



GRADE	PRETERM BIRTH RATE RANGE SCORING CRITERIA
A	Less than or equal to 7.7%.
A-	Preterm birth rate of 7.8 to 8.1%.
B+	Preterm birth rate of 8.2 to 8.5%.
B	Preterm birth rate of 8.6 to 8.9%.
B-	Preterm birth rate of 9.0 to 9.2%.
C+	Preterm birth rate of 9.3 to 9.6%
C	Preterm birth rate of 9.7 to 10.0%
C-	Preterm birth rate of 10.1 to 10.3%
D+	Preterm birth rate of 10.4 to 10.7%.
D	Preterm birth rate of 10.8 to 11.1%.
D-	Preterm birth rate of 11.2 to 11.4%.
F	Preterm birth rate greater than or equal to 11.5%.

Puerto Rico is not included in the United States total.

Preterm is less than 37 completed weeks of gestation, based on obstetric estimate of gestational age.

Source: National Center for Health Statistics, 2020 final natality data.

Grades assigned by March of Dimes Perinatal Data Center.

www.marchofdimes.org/reportcard

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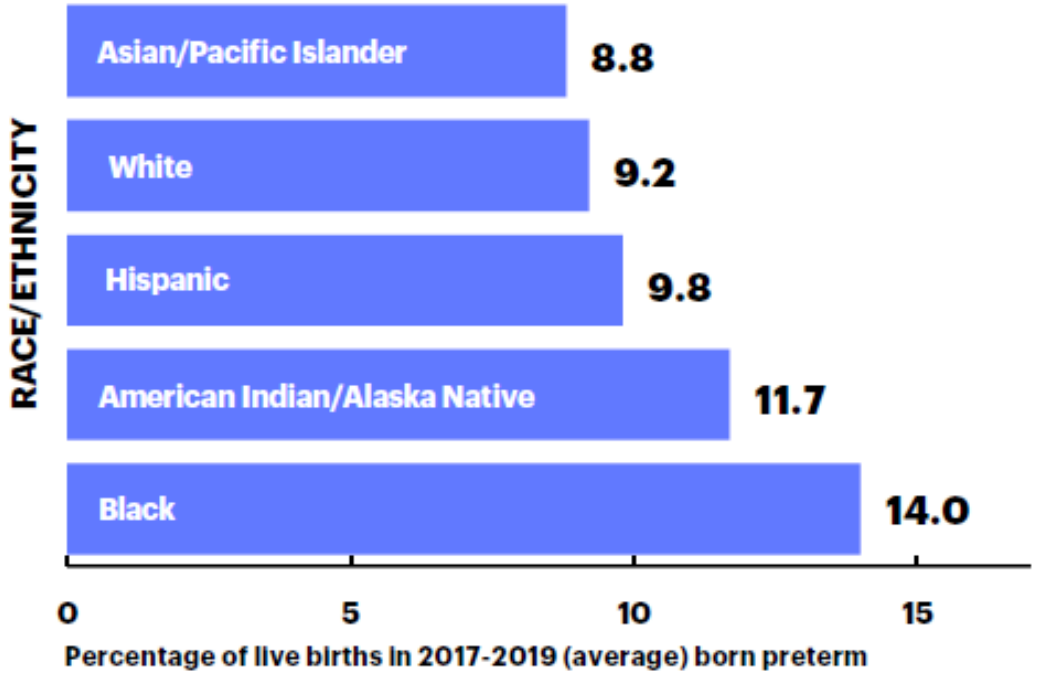
INFANT HEALTH

Aggregate 2017-2019 preterm birth rates are shown for each of the five bridged racial and ethnic groups. The racial/ethnic group with the highest rate is compared to the combined rate for all other racial/ethnic groups



In the United States, the preterm birth rate among Black women is 51% higher than the rate among all other women.

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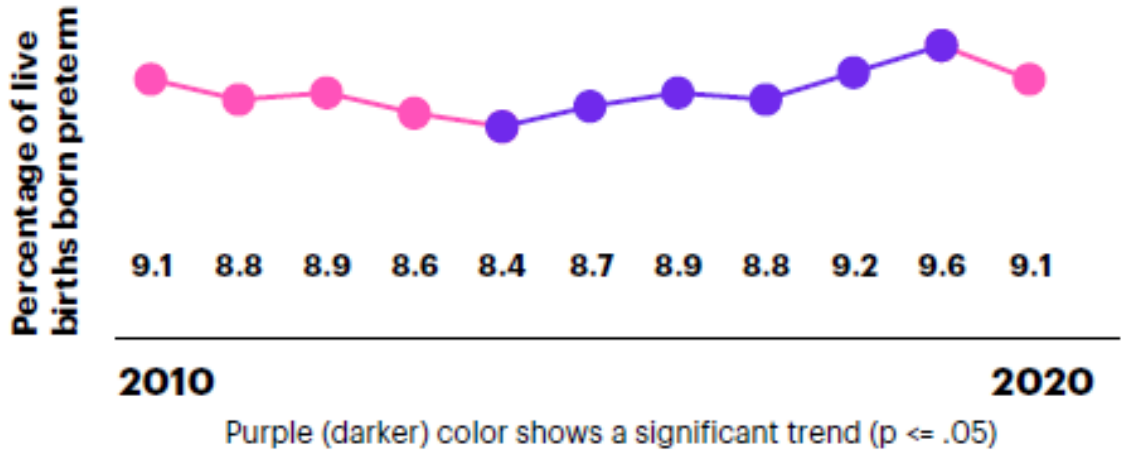
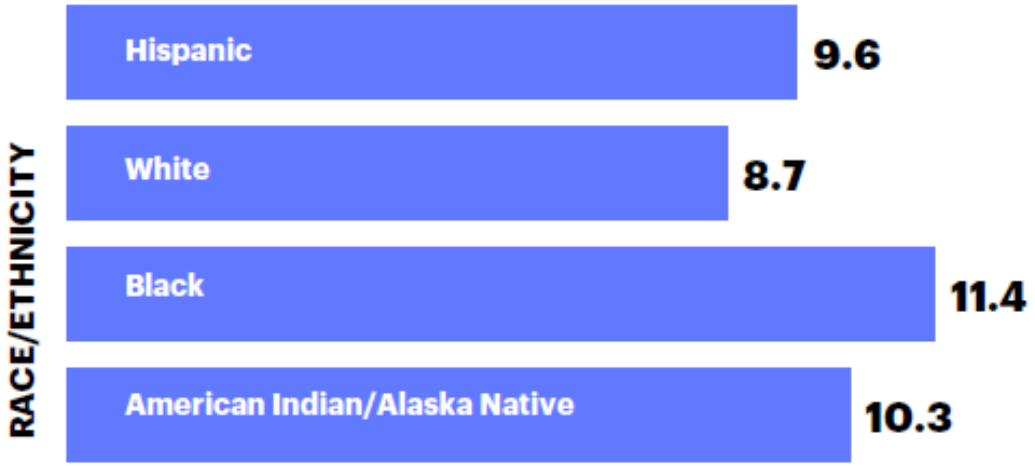
PRETERM BIRTH RATE

9.1%



Purple (darker) color shows a significant trend (p <= .05)



In Colorado, the preterm birth rate among Black women is 27% higher than the rate among all other women.

DISPARITY RATIO:

- Of all live births in Colorado during 2017-2019 (average), 28.5% were Hispanic, 59.0% were white, 5.6% were black, 0.7% were American Indian/Alaska Native and 4.7% were Asian/Pacific Islander.

Percentage of live births in 2017-2019 (average) born preterm

No Improvement

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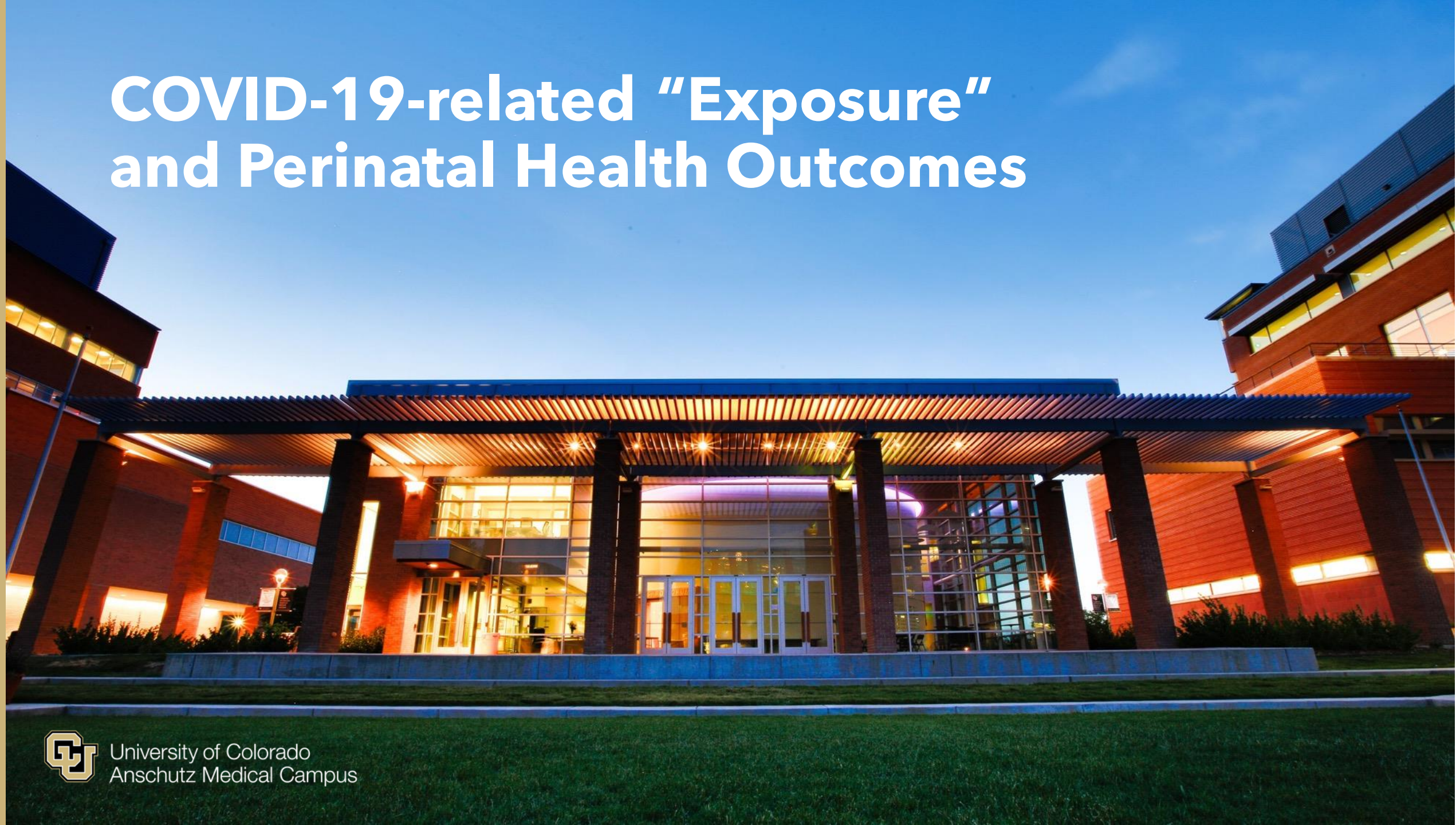
COVID-19-related "Exposure" and Perinatal Health Outcomes



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Association of Preterm Birth Rate With COVID-19 Statewide Stay-at-Home Orders in Tennessee

- Statewide stay-at-home orders announced March 22 and expired on April 30
- Odds of preterm birth in Tennessee during the 2020 stay-at-home order compared with the same periods in 2015 to 2019

Harvey et al. JAMA Ped 2021.

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Table. Characteristics of All Births and Preterm Births During March 22 to April 30, 2020, Compared With the Corresponding Periods in 2015 to 2019, Tennessee

Characteristic	All births No./total No. (%) 2015-2019	All births No./total No. (%) 2020	*P* value	Preterm births (<37 weeks' gestation) No. (%) 2015-2019	Preterm births (<37 weeks' gestation) No. (%) 2020	*P* value
Maternal race/ethnicity						
Hispanic	3893/41 577 (9.4)	952/7553 (12.6)	<.001	367/4693 (7.8)	99/762 (13.0)	<.001
Non-Hispanic White	27 742/41 577 (66.7)	4881/7553 (64.6)		2876/4693 (61.3)	438/762 (57.5)	
Non-Hispanic Black	8147/41 577 (19.6)	1364/7553 (18.1)		1256/4693 (26.8)	184/762 (24.1)	
Non-Hispanic Asian	973/41 577 (2.3)	192/7553 (2.5)		94/4693 (2.0)	20/762 (2.6)	
Non-Hispanic other	822/41 577 (2.0)	164/7553 (2.2)		100/4693 (2.1)	21/762 (2.8)	

Harvey et al. JAMA Ped 2021.

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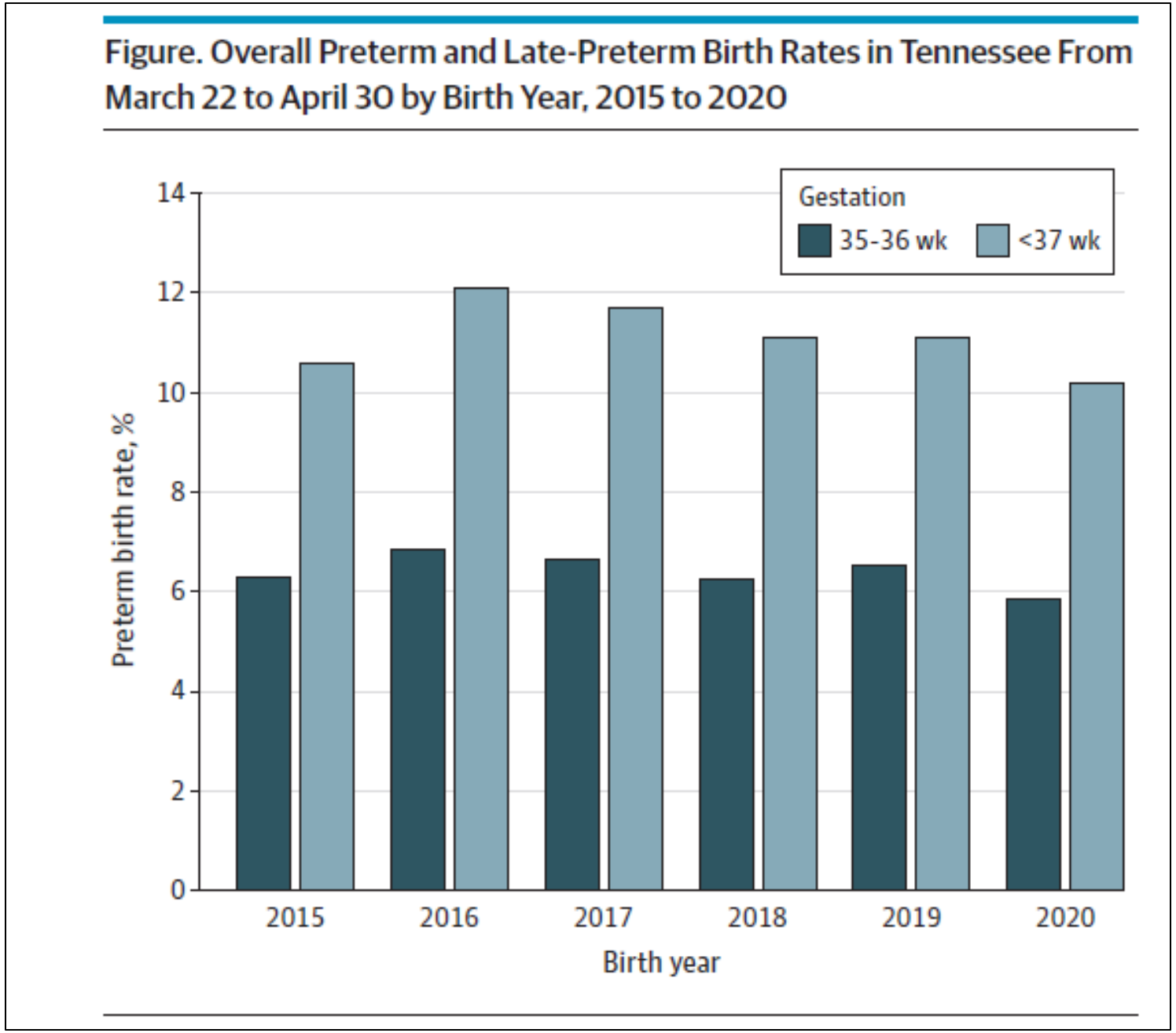

Harvey et al. JAMA Ped 2021.

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Original Research

Coronavirus Disease 2019 (COVID-19) Pandemic and Pregnancy Outcomes in a U.S. Population

Moeun Son, MD, MSCI, Kieran Gallagher, MPH, Justin Y. Lo, PhD, MT(ASCP), Eric Lindgren, JD, Heather H. Burris, MD, MPH, Kevin Dysart, MD, Jay Greenspan, MD, Jennifer F. Culhane, PhD MPH, and Sara C. Handley, MD, MSCE

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Son et al. Obstetrics & Gynecol 2021.

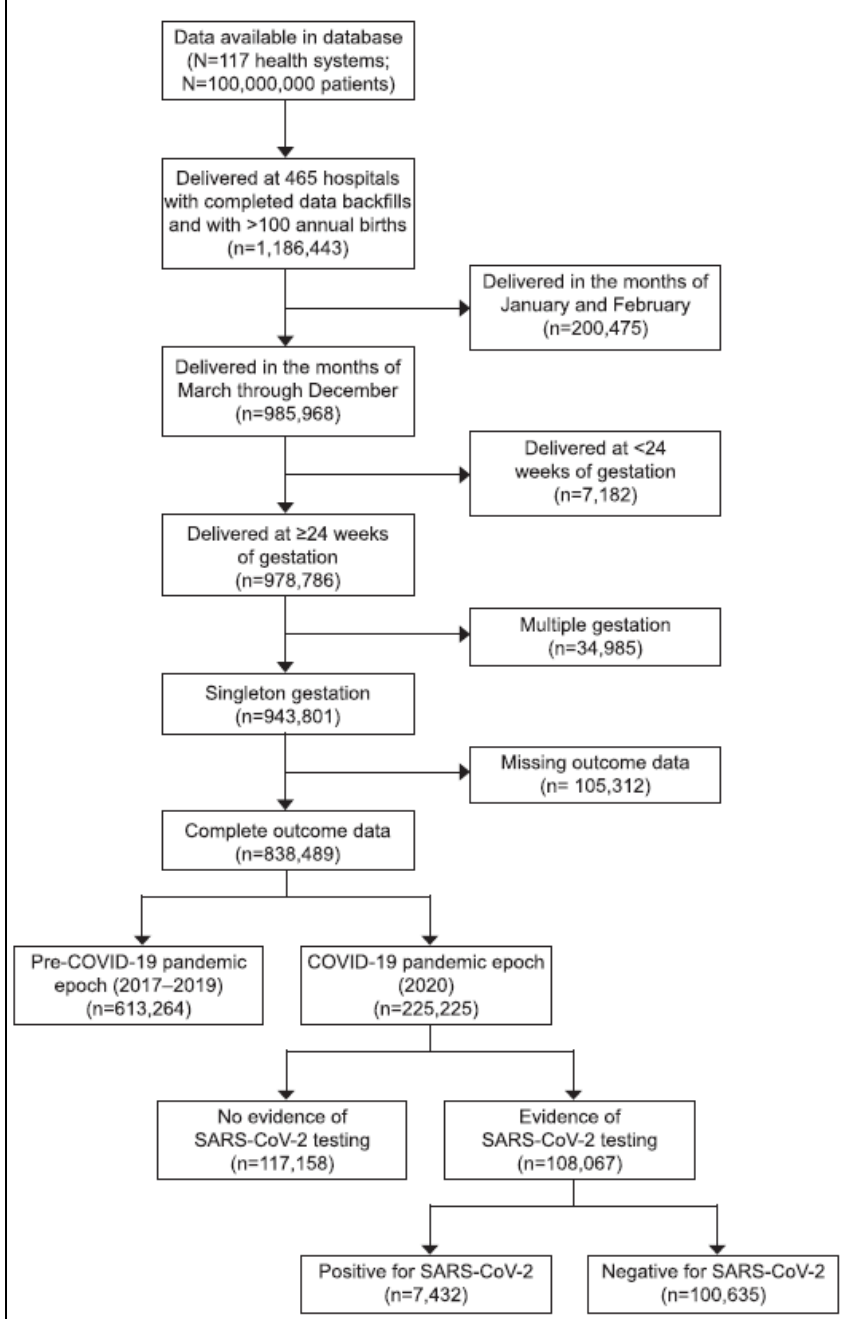

Fig. 1. Study cohort identification flow diagram. COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Harvey et al. JAMA Ped 2021.

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Table 2. Neonatal and Adverse Pregnancy Outcomes Before and During the Coronavirus Disease 2019 (COVID-19) Pandemic

Outcome	Epoch		Standardized Difference
	Pre–COVID-19 Pandemic (n=613,264)	COVID-19 Pandemic (n=225,225)	
Preterm birth*	47,286 (7.7)	17,205 (7.6)	0.003
Stillbirth	2,039 (0.3)	772 (0.3)	−0.002
Birth weight category			
SGA	41,760 (6.8)	14,657 (6.5)	0.012
AGA	525,152 (85.6)	193,075 (85.7)	−0.003
LGA	46,352 (7.6)	17,493 (7.8)	−0.008
HDP	83,764 (13.7)	34,573 (15.4)	−0.048
Placental abruption	2,355 (0.4)	907 (0.4)	−0.003
Cesarean birth	189,080 (30.8)	66,042 (29.3)	0.033
PPH	14,280 (2.3)	6,137 (2.7)	−0.025

COVID-19, coronavirus disease 2019; SGA, small for gestational age; AGA, appropriate for gestational age; LGA, large for gestational age; HDP, hypertensive disorders of pregnancy; PPH, postpartum hemorrhage.
Data are n (%) unless otherwise specified.
* Preterm birth is defined as birth before 37 weeks of gestation.

Harvey et al. JAMA Ped 2021.

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Table 5. Mixed Effects Logistic Regression Models to Evaluate the Association Between Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Positivity and Pregnancy Outcomes

Outcome	Crude OR (95% CI)	Adjusted OR (95% CI)*
Preterm birth[†]	1.12 (1.01–1.26)	1.11 (0.98–1.25)
Cesarean birth	1.09 (1.02–1.16)	1.06 (0.99–1.13)

OR, odds ratio.

* Adjusted for maternal age, race and ethnicity, insurance type, high-risk Social Vulnerability Index, obesity, chronic hypertension, pregestational diabetes, heart disease, urban area, and hospital system as a random intercept.

[†] Preterm birth is defined as birth before 37 weeks of gestation.

Harvey et al. JAMA Ped 2021.

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Stay-At-Home Orders and Preterm Birth in Colorado

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Objectives

- To provide a larger evidence base for if and how COVID-19 restrictions affected the birthing population at a state level, we sought to:
  - 1) compare preterm birth rates during the periods before and after COVID-19 stay-at-home orders were issued
  - 2) assess whether change in preterm birth rates varied across racial/ethnic groups in Colorado.

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GOVERNOR

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DENVER, COLORADO 80203

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D 2020 017

EXECUTIVE ORDER

Ordering Coloradans to Stay at Home Due to the Presence of COVID-19 in the State

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to Article IV, Section 2 of the Colorado Constitution and the relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.* (Act), I, Jared Polis, Governor of the State of Colorado, hereby issue this Executive Order ordering Coloradans to stay at home whenever possible due to the presence of coronavirus disease 2019 (COVID-19) in the State.

https://www.colorado.gov/governor/sites/default/files/inline-files/D%202020%20017%20Ordering%20Coloradans%20to%20Stay%20at%20Home_0.pdf

Methods: Data Source

- *Colorado birth certificate records*
- *April to December 2015 - 2020 to account for seasonality in the pre and post-COVID-19 stay-at-home orders*
  - Pre-period: April-December 2015-2019
  - Post-period: April-December 2020

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Methods: Cohort Selection

- *Excluded records with missing/unreasonable values:*
  - birth weight (<300g)
  - gestational age (<20 or >44 weeks)
  - infant sex
  - delivery method
  - insurance type
  - maternal race/ethnicity
  - maternal age
  - highest education
  - marital status

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Methods: Outcomes

- Preterm birth, defined as gestational age < 37 weeks.
- Gestational age on birth certificates is typically calculated from clinical estimates by first trimester ultrasound.
- If ultrasound not available or missing, the gestational age is calculated based upon estimated date of last menstrual period.

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Methods: Analysis

- Compared maternal and infant characteristics for all and preterm births for pre and post periods via χ^2 tests
- Logistic regression models to assess adjusted odds of preterm birth, comparing pre to post birth cohorts
  - All variables significant in bivariate analysis were included.
- Interaction term between maternal race/ethnicity and pre-/post periods to compare the difference in mean preterm birth rates between NHW and each racial/ethnic group
- Stratification by race/ethnicity
  - Crude difference in preterm birth between 2015-2019 and 2020 via χ^2 tests
  - Adjusted odds ratios for preterm birth in post-period with logistic regression models adjusting for the same covariates as in the overall model.

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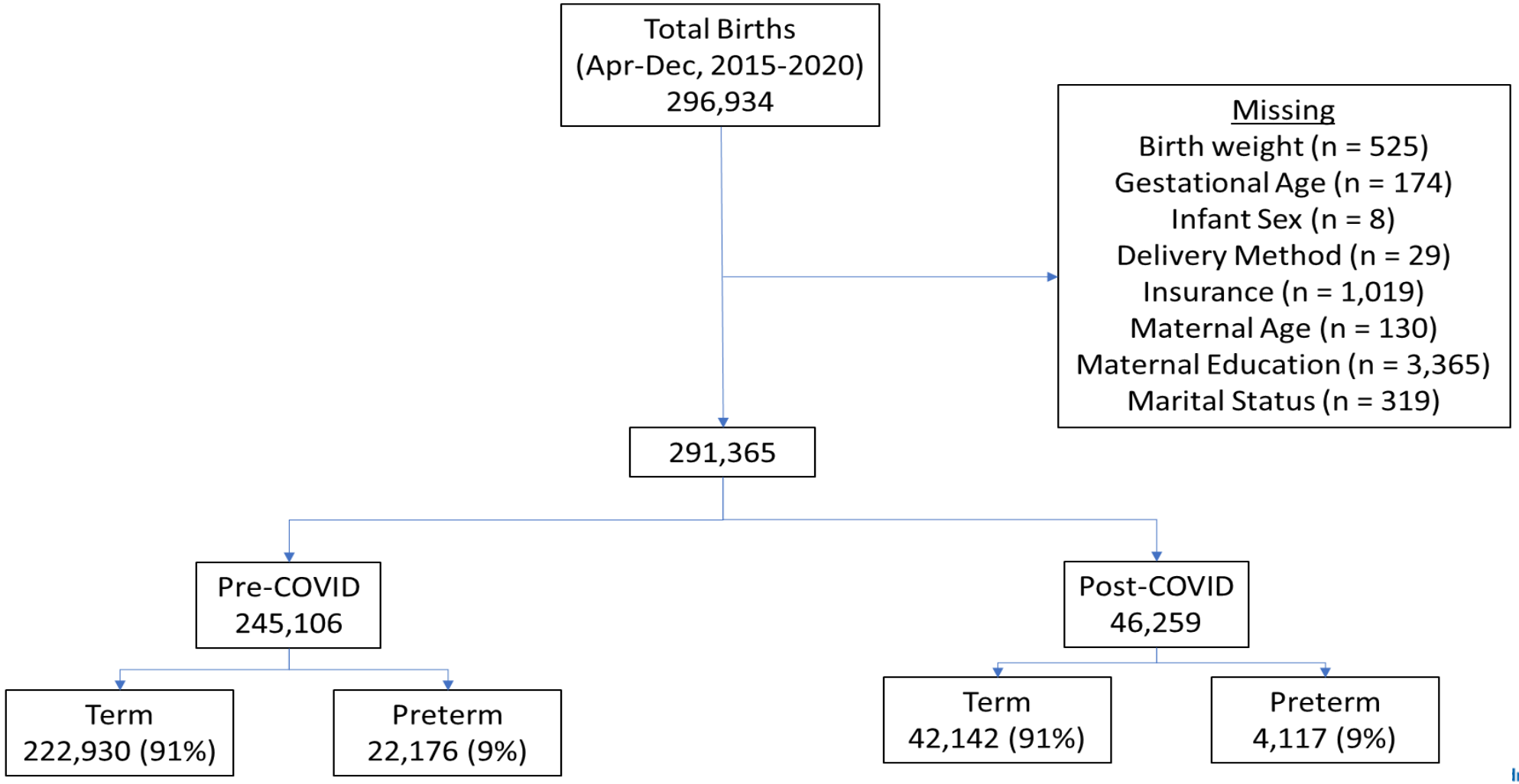
Results: Cohort Selection Figure



Hwang SS, Weikel BW, Hannan KE, Bourque, SL. JPeds 2021.

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Table 1: Characteristics of All Births and Preterm Births

	All Births			Preterm Births		
Characteristic	**2015-2019**	**2020**	**p-value**	**2015-2019**	**2020**	**p-value**
	N (%)	N (%)		N (%)	N (%)	
	245,106	46,259		22,176	4,117	
Age			**<0.0001**			**0.0084**
<20	10,540 (4.3)	1,647 (3.6)		1,024 (4.6)	161 (3.9)	
20-24	42,365 (17.3)	7,495 (16.2)		3,826 (17.3)	657 (16.0)	
25-34	144,120 (58.8)	27,279 (59.0)		12,146 (54.8)	2,266 (55.0)	
≥35	48,081 (19.6)	9,838 (21.3)		75,180 (23.4)	1,033 (25.1)	
Race/Ethnicity			**<.0001**			**0.0009**
Non-Hispanic White	143,708 (58.6)	26,329 (56.9)		12,324 (55.6)	2,172 (52.8)	
Non-Hispanic Black	11,111 (4.5)	2,301 (5.0)		1,253 (5.7)	290 (7.0)	
Native	2,470 (1.0)	493 (1.1)		272 (1.2)	15 (0.4)	
Hispanic	67,837 (27.7)	13,374 (28.9)		6,327 (28.5)	1,224 (29.7)	
Other	19,980 (8.2)	3,762 (8.1)		2,000 (9.0)	376 (9.1)	

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	All Births			Preterm Births		
Characteristic	**2015-2019**	**2020**	**p-value**	**2015-2019**	**2020**	**p-value**
Education			**<.0001**			0.1839
<High School	27,626	4,727		2,824	511	
	(11.3)	(10.2)		(12.7)	(12.4)	
High School/GED	49,042	9,449		4,732	931	
	(20.0)	(20.4)		(21.3)	(22.6)	
Some	27,089	12,836		6,903	1,229	
College/Associate's	(29.4)	(27.7)		(31.1)	(29.9)	
≥ Bachelor's	96,349	19,247		7,717	1,446	
Degree	(39.3)	(41.6)		(34.8)	(35.1)	
Marital Status			0.3059			**0.0220**
Married	186,612	35,117		16,045	2,907	
	(76.1)	(75.9)		(72.4)	(70.6)	
Other	54,949	11,142		6,131	1,210	
	(23.9)	(24.1)		(27.7)	(29.4)	
Insurance			**<.0001**			**<0.0001**
Public	108,652	19,238		10,635	1,917	
	(44.3)	(41.6)		(48.0)	(48.6)	
Other	129,092	25,097		10,819	1,977	
	(52.7)	(54.3)		(48.8)	(48.0)	
Self-Pay	7,361	1,924		722	223	
	(3.0)	(4.2)		(3.3)	(5.4)	

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Characteristic	All Births 2015-2019	All Births 2020	All Births p-value	Preterm Births 2015-2019	Preterm Births 2020	Preterm Births p-value
Previous Live Birth			**<.0001**			0.3585
Yes	142,757 (60.1)	26,977 (58.3)		13,790 (62.1)	2,529 (61.4)	
No	97,849 (39.9)	19,282 (41.7)		8,386 (37.8)	1,588 (38.6)	
Previous Preterm Birth			**<.0001**			**0.0001**
Yes	7,276 (3.0)	1,582 (3.4)		1,919 (8.7)	432 (10.5)	
No	237,830 (97.0)	44,677 (96.6)		20,257 (91.3)	3,685 (89.5)	
1st Trimester Prenatal Care			**0.0003**			0.8840
Yes	191,704 (78.2)	36,530 (79.0)		16,054 (72.4)	2,985 (72.5)	
No	53,402 (21.8)	9,729 (21.0)		6,122 (27.6)	1,132 (27.5)	
Any Diabetes			**<.0001**			**<.0001**
Yes	13,698 (5.6)	3,335 (7.2)		2,158 (9.7)	490 (11.9)	
No	231,408 (94.4)	42,924 (92.8)		20,018 (90.3)	3,627 (88.1)	
Any Hypertension			**<.0001**			**<.0001**
Yes	20,542 (8.4)	5,226 (11.3)		4,428 (20.0)	948 (23.0)	
No	224,564 (91.6)	41,033 (88.7)		17,748 (80.0)	3,169 (77.0)	
Delivery Method			**<.0001**			**0.0039**
Vaginal	180,331 (73.6)	33,627 (72.7)		11,826 (53.3)	2,095 (50.9)	
Cesarean	64,775 (26.4)	12,632 (27.3)		10,350 (46.7)	2,022 (49.1)	

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Figure 2: Preterm Birth by Birth Year: Overall, Early, Late Preterm Births, Apr-Dec 2015-2020

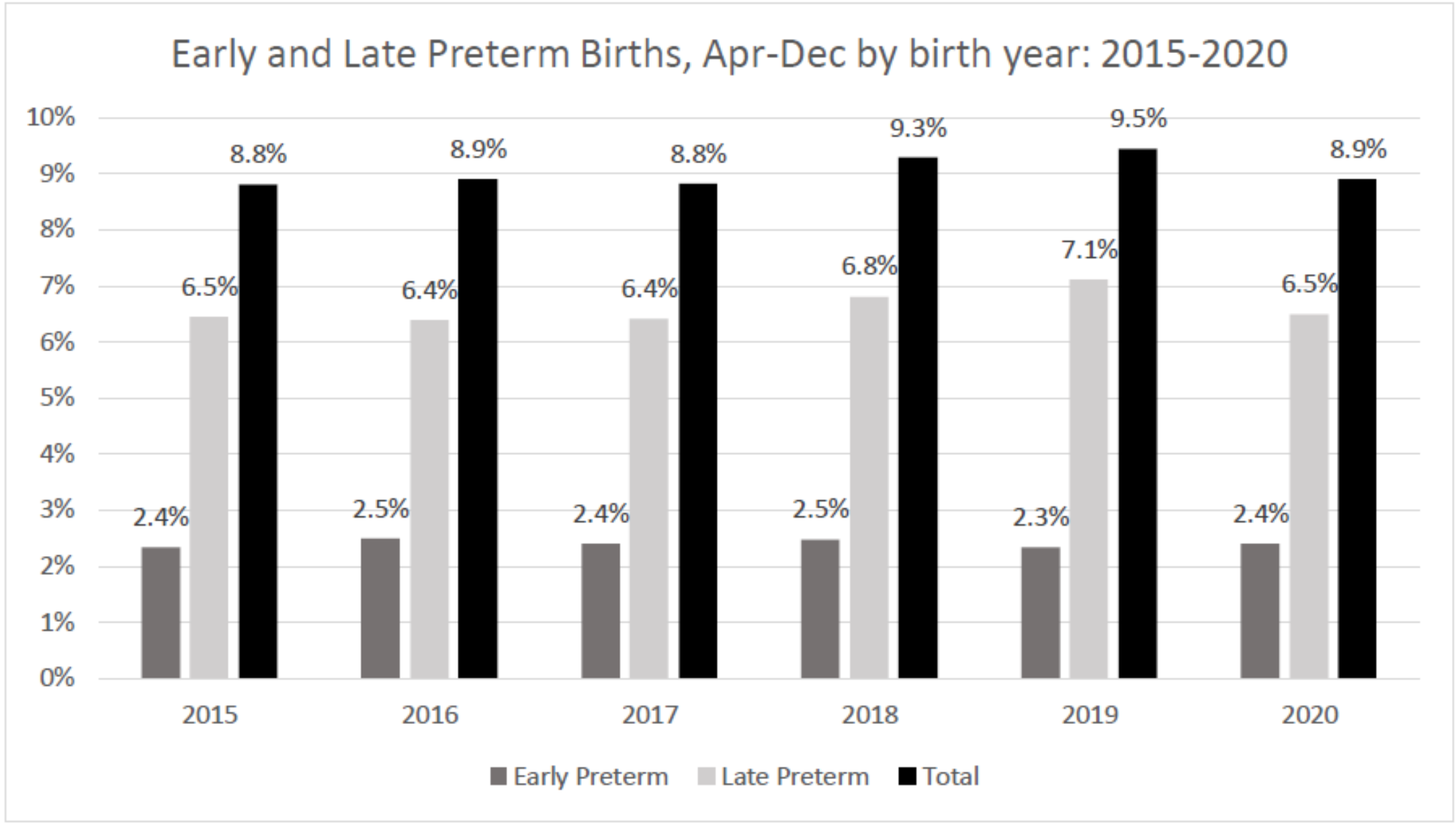

Table 2: Adjusted Odds Ratios for Preterm Term by Maternal Race/Ethnicity

Maternal Race/Ethnicity	Total Live Births Count (N)	Overall	2015-2019	2020	p-value[+]	Adjusted OR (95% CI)[*]
		N (%)	N (%)	N (%)		
Total	291,365	26,293 (9.0)	22,176 (9.0)	4,117 (8.9)	0.3095	**0.923 (0.901, 0.957)**
Non-Hispanic white	170,037	14,496 (8.5)	12,324 (8.6)	2,172 (8.3)	0.0814	**0.911 (0.867, 0.956)**
Non-Hispanic Black	13,142	1,543 (11.5)	1,253 (11.3)	290 (12.6)	0.0696	1.055 (0.917, 1.213)
American Indian/Alaska Native	2,963	327 (11.0)	272 (11.0)	55 (11.2)	0.9258	0.983 (0.713, 1.355)
Hispanic	81,211	7,551 (9.3)	6,327 (9.3)	1,224 (9.2)	0.5249	**0.910 (0.852, 0.956)**
Other	23,742	2,237 (10.0)	2,000 (10.0)	376 (10.0)	0.9771	0.951 (0.844, 1.072)

[+]unadjusted chi-sq

[*]adjusted for maternal age, education, marital status, insurance, previous preterm birth, 1st trimester prenatal care, diabetes and hypertension

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Take Home Points

- While NHW and Hispanic mothers experienced lower preterm birth rates in the post-stay-at-home period, NHB and AI/AN mothers did not experience this decline.

- The Black-White disparity in preterm birth increased during our study period.

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Limitations

- The focus on births from one state, limiting potential generalizability beyond Colorado.
- Our analysis was limited to maternal race/ethnicity as captured by the birth certificates and did not account for country of origin or immigrant status.
- We also recognize the heterogeneity within each racial/ethnic group and that each subgroup may have been impacted by the COVID restrictions in different ways.

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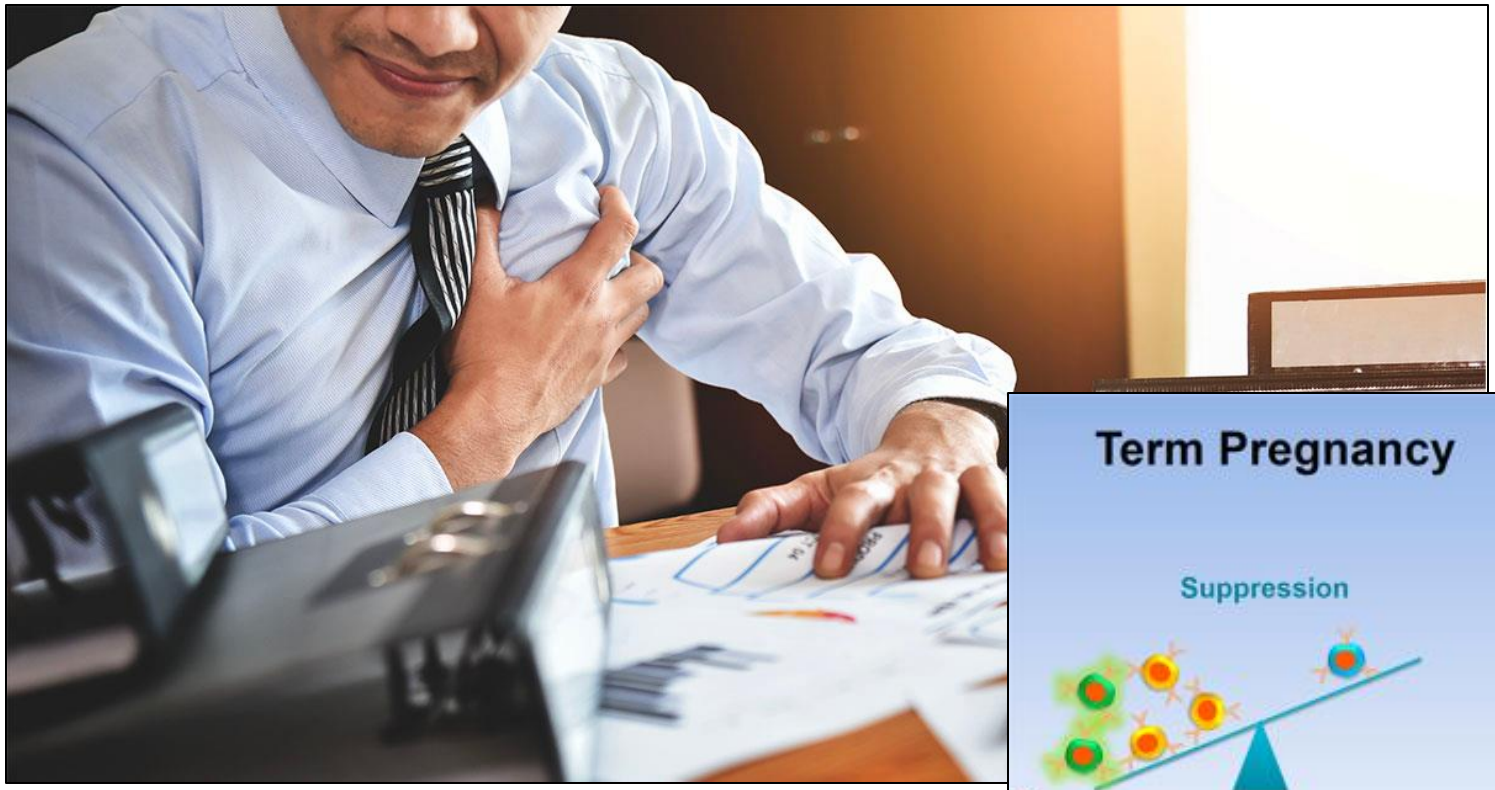
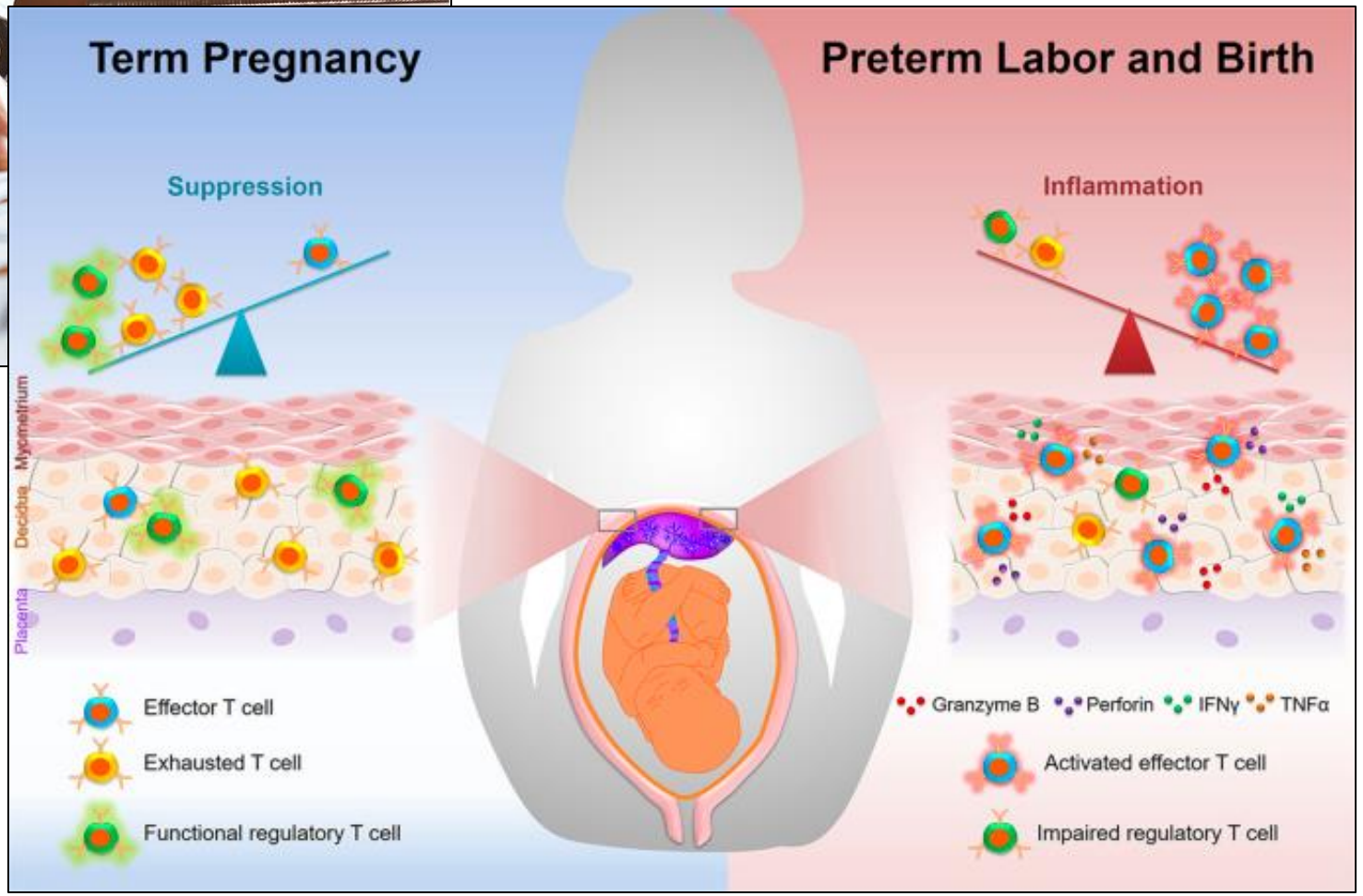
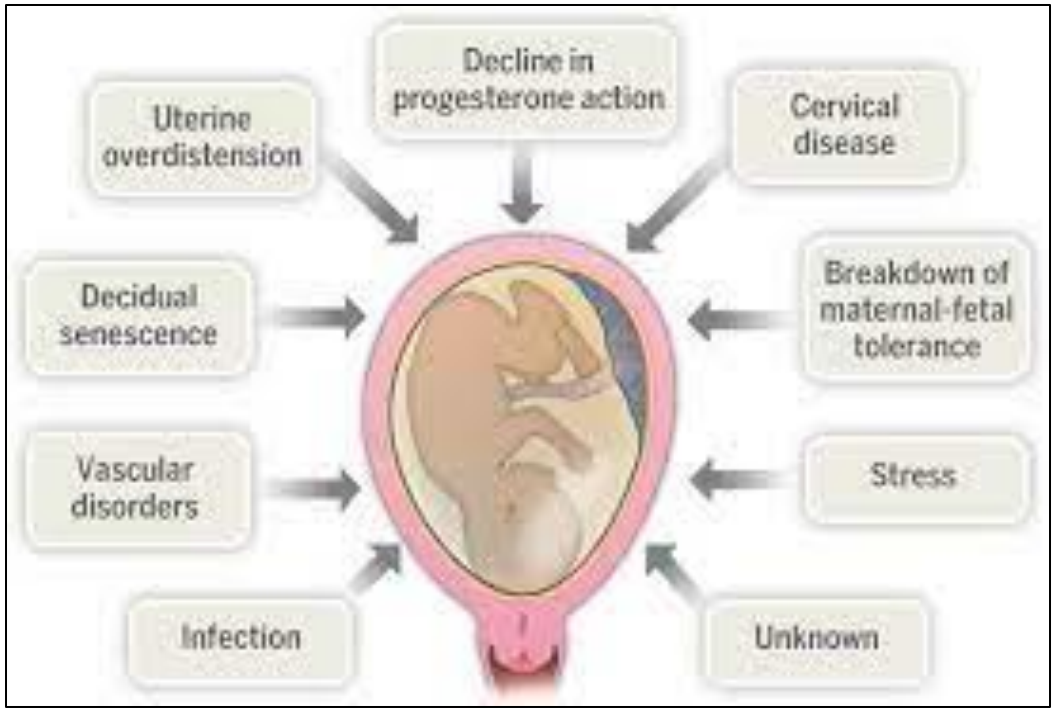
Discussion and Hypotheses




Term Pregnancy
Preterm Labor and Birth
Suppression
Inflammation
Myometrium
Decidua
Placenta
Effector T cell
Exhausted T cell
Functional regulatory T cell
Granzyme B
Perforin
IFNγ
TNFα
Activated effector T cell
Impaired regulatory T cell



https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

https://www.science.org/doi/full/10.1126/science.1251816

Well-being of Parents and Children During the COVID-19 Pandemic: A National Survey

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abstract

BACKGROUND: As the coronavirus disease pandemic spread across the United States and protective measures to mitigate its impact were enacted, parents and children experienced widespread disruptions in daily life. Our objective with this national survey was to determine how the pandemic and mitigation efforts affected the physical and emotional well-being of parents and children in the United States through early June 2020.

METHODS: In June 2020, we conducted a national survey of parents with children age <18 to measure changes in health status, insurance status, food security, use of public food assistance resources, child care, and use of health care services since the pandemic began.

RESULTS: Since March 2020, 27% of parents reported worsening mental health for themselves, and 14% reported worsening behavioral health for their children. The proportion of families with moderate or severe food insecurity increased from 6% before March 2020 to 8% after, employer-sponsored insurance coverage of children decreased from 63% to 60%, and 24% of parents reported a loss of regular child care. Worsening mental health for parents occurred alongside worsening behavioral health for children in nearly 1 in 10 families, among whom 48% reported loss of regular child care, 16% reported change in insurance status, and 11% reported worsening food security.

CONCLUSIONS: The coronavirus disease pandemic has had a substantial tandem impact on parents and children in the United States. As policy makers consider additional measures to mitigate the health and economic effects of the pandemic, they should consider the unique needs of families with children.

Patrick et al. Pediatrics 2020.

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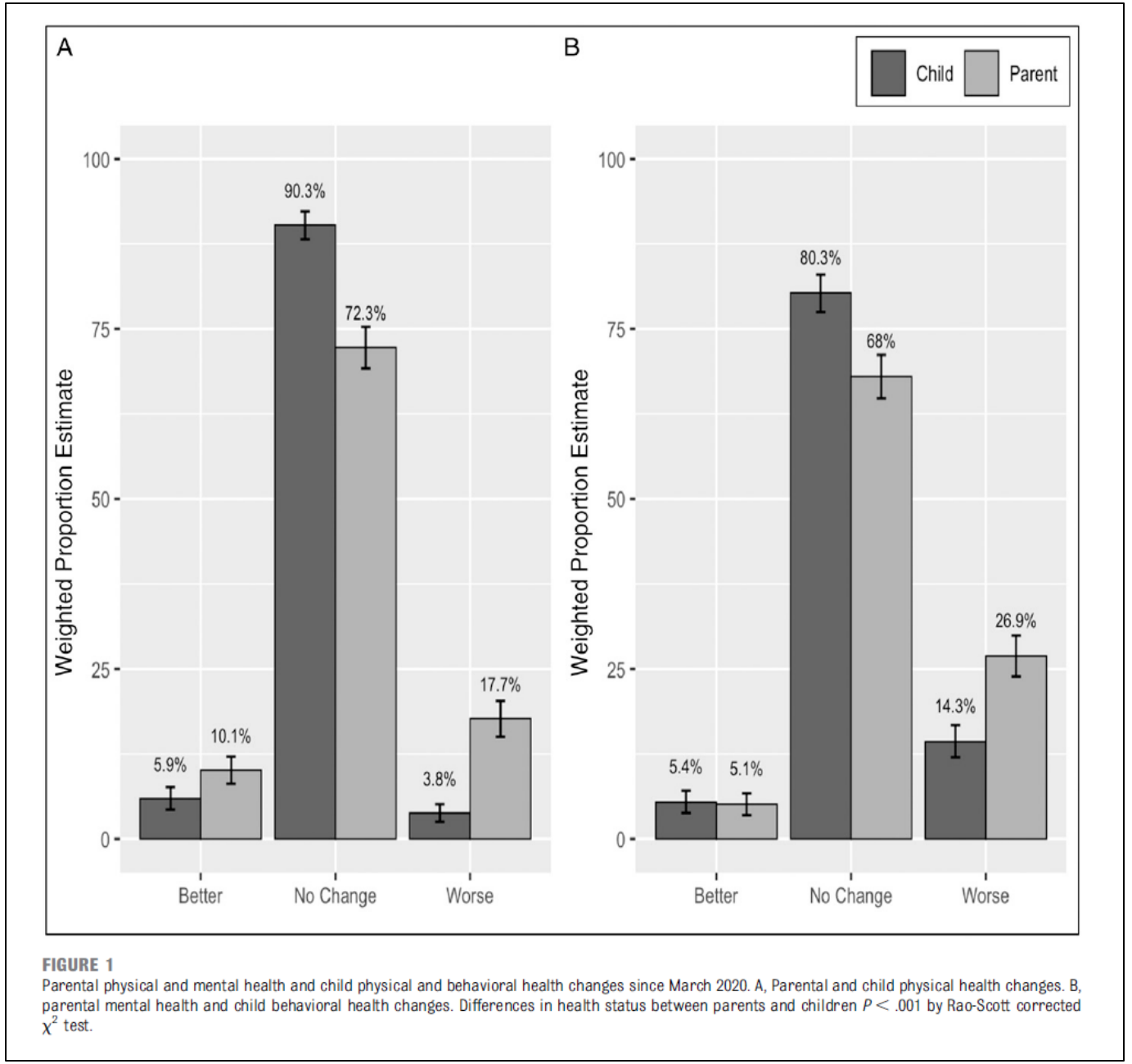

FIGURE 1
Parental physical and mental health and child physical and behavioral health changes since March 2020. A, Parental and child physical health changes. B, parental mental health and child behavioral health changes. Differences in health status between parents and children $P < .001$ by Rao-Scott corrected χ^2 test.

Patrick et al. Pediatrics 2020.

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PNAS

Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure

Christopher W. Tessum[a], Joshua S. Apte[b], Andrew L. Goodkind[c], Nicholas Z. Muller[d], Kimberley A. Mullins[e], David A. Paolella[a], Stephen Polasky[f,g], Nathaniel P. Springer[h], Sumil K. Thakrar[i], Julian D. Marshall[a], and Jason D. Hill[i,1]

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Tessum et al. PNAS 2019.

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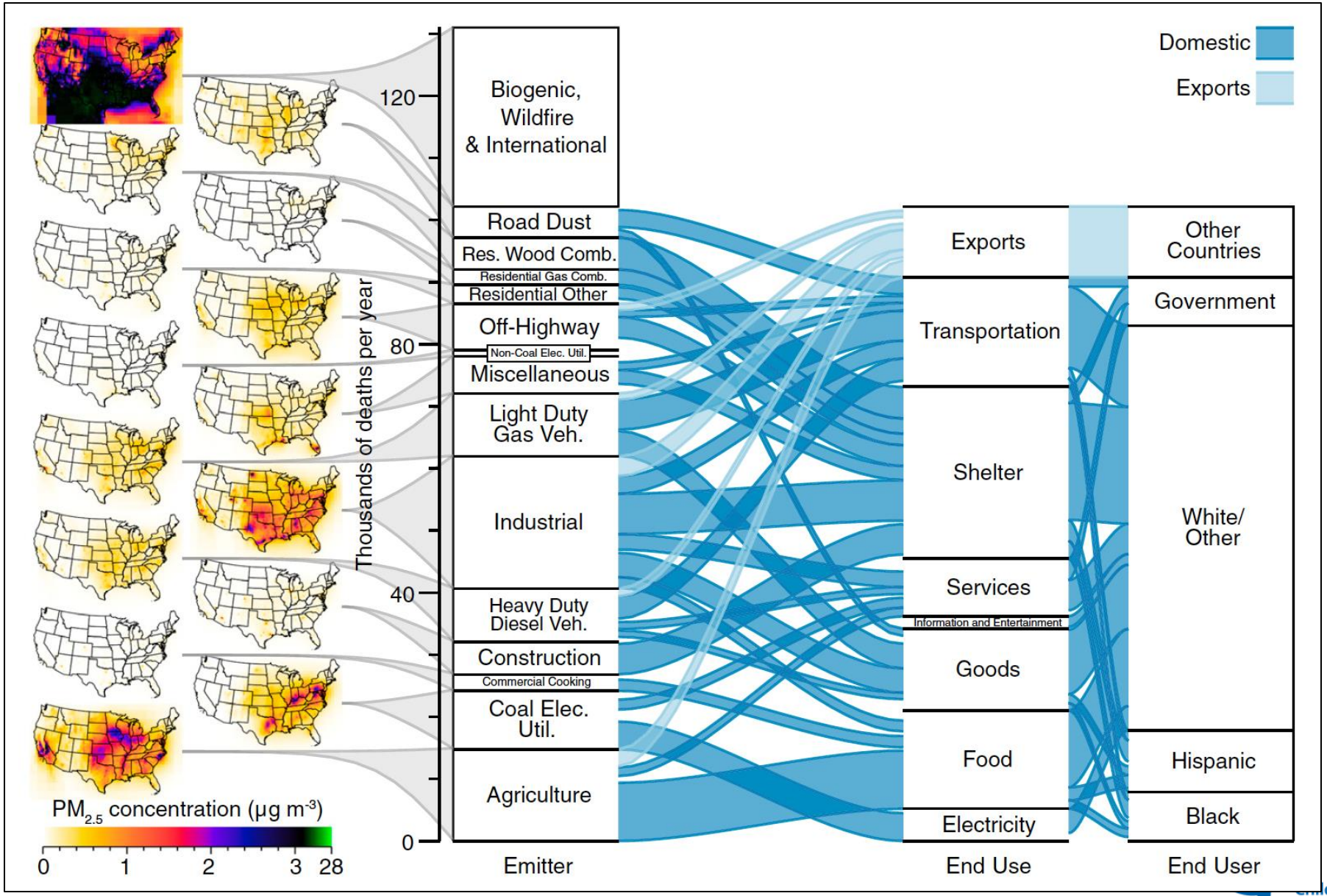

Tessum et al. PNAS 2019.

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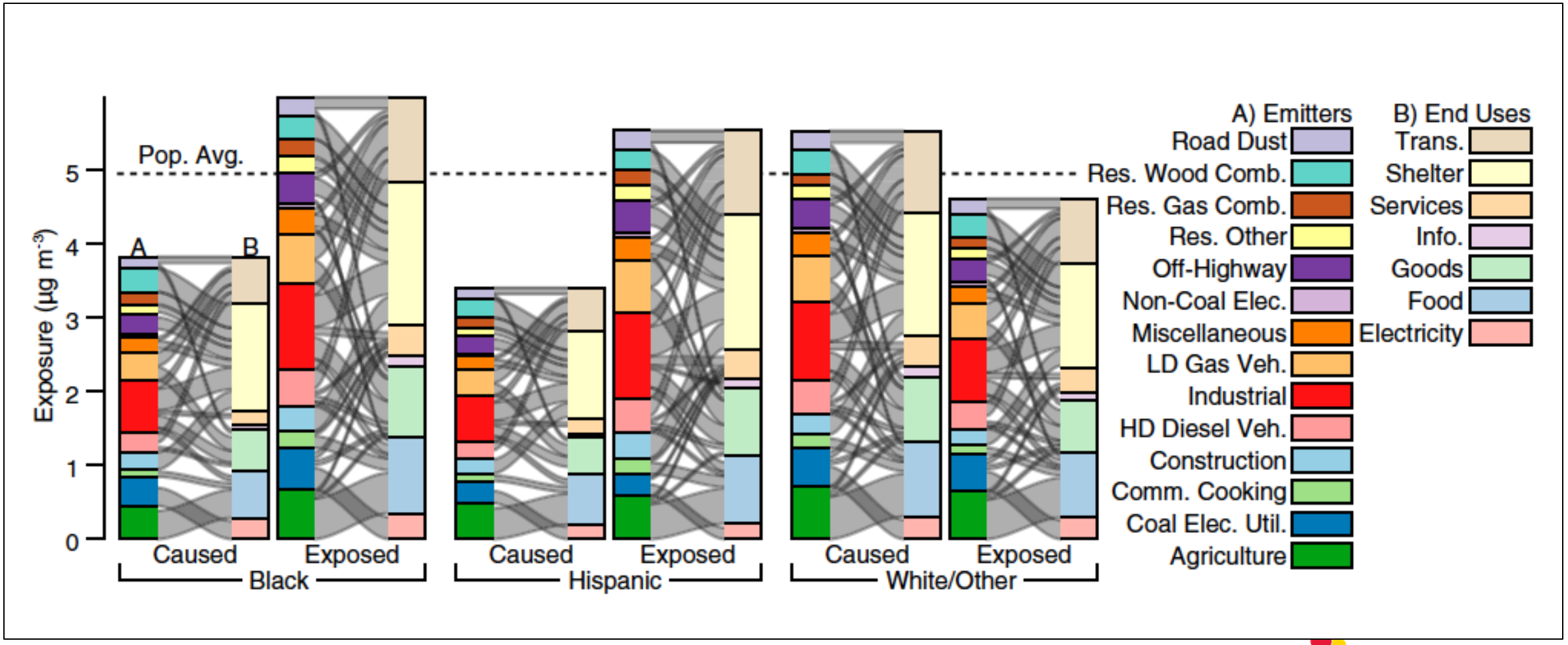

Tessum et al. PNAS 2019.

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Conclusions

- Potentially broader family and/or community supports could allow some pregnant individuals to better weather the enormous stress caused by the pandemic and maintain perinatal health.
- NHB and AI/AN women have the highest maternal and infant mortality rates in the U.S. and we hypothesize that the broad array of factors related to health status, healthcare access, social determinants of health and racism likely persisted in the post-restriction period and thus these groups experienced no decline in their preterm birth rates.
- The Black-White disparity in preterm birth increased during our study period, highlighting the urgent need to disaggregate perinatal health data to fully understand differential impacts of both negative and positive exposures on our birthing population.

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Pediatric
COVID-19
Vaccination

COVID-19 Vaccine Approval Process

01 Food & Drug Administration sets rigorous standards for COVID-19 vaccine testing in humans

02 Phase I - Clinical trials in a small group of volunteers to determine safety

03 Phase II - Safety and efficacy of a slightly larger study group

04 Phase III - Researches safety and efficacy of vaccine on very large trial group against control groups

05 Clinical trials complete by medical & research professionals

06 FDA reviews scientific data and other information

07 FDA makes a recommendation to the Advisory Committee on Immunization Practices (ACIP)

08 ACIP reviews clinical trial data (age, race, ethnicity, underlying medical conditions, responses to vaccine, side effects, etc.)

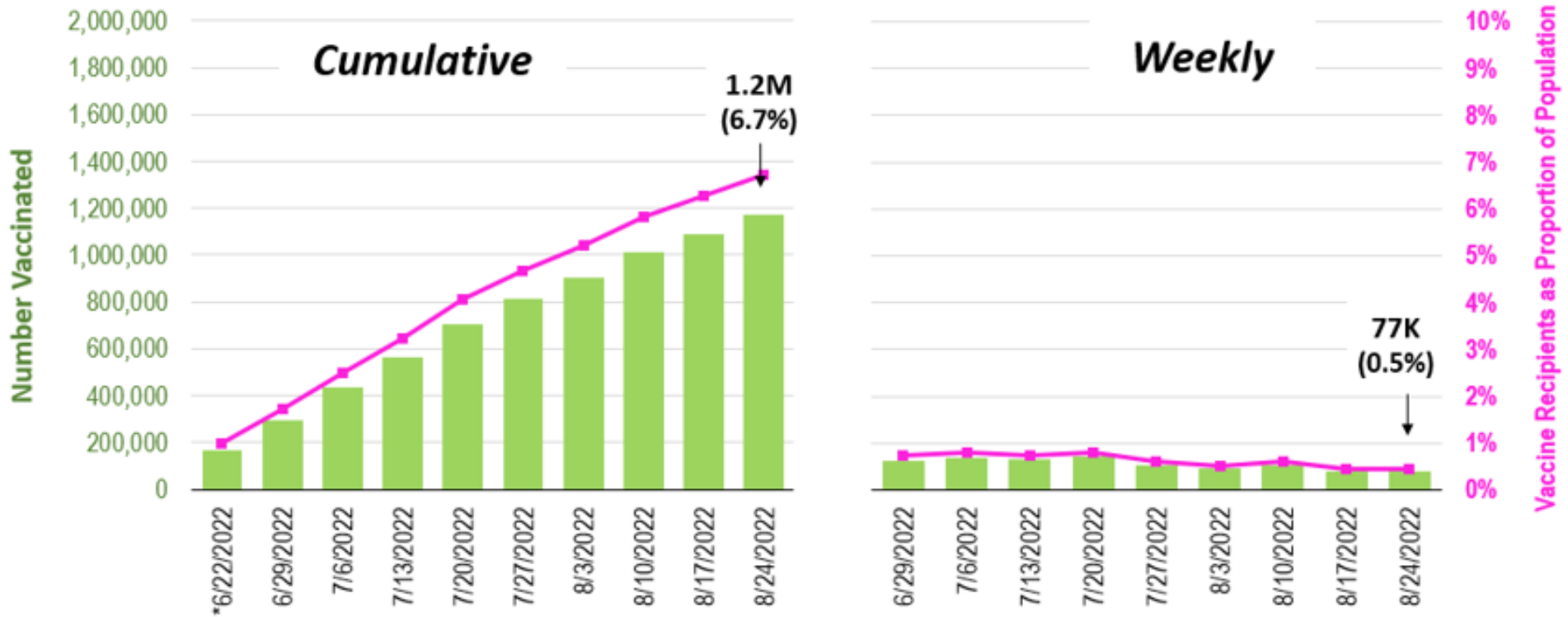
09 ACIP makes a recommendation to CDC on vaccine and who should receive it

10 CDC makes vaccine available

11 Colorado's vaccine distribution plan engaged

Number and Proportion of US Infants and Children Ages 6 Months - 4 Years Receiving Initial Dose of COVID-19 Vaccine

6.22.2022 to 8.24.2022



1.2M US children ages 6 mos – 4 years had received at least 1 dose of COVID-19 vaccine

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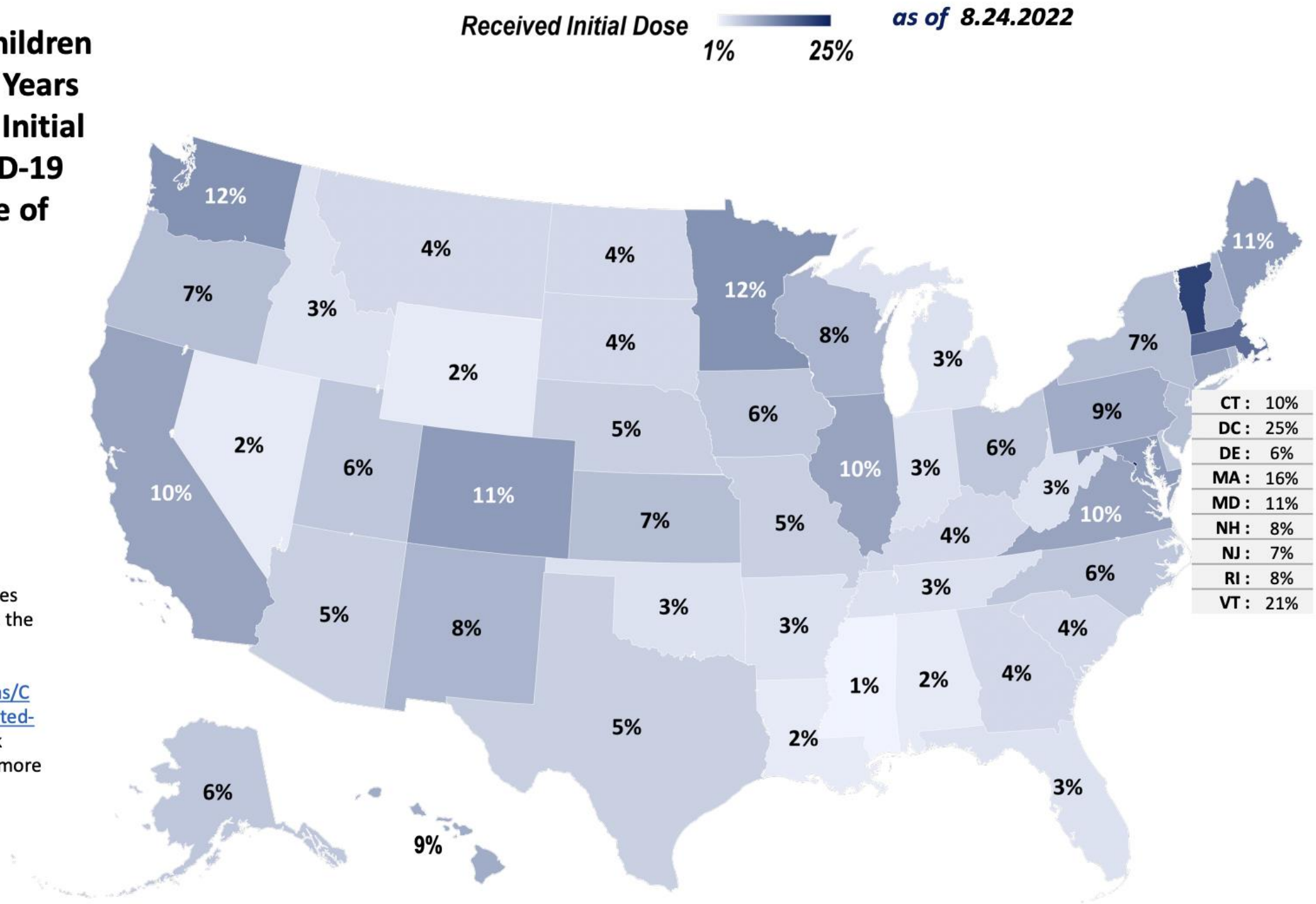
Proportion of US Children Ages 6 Months - 4 Years Who Received the Initial Dose of the COVID-19 Vaccine, by State of Residence



Source: AAP analysis of data series titled "COVID -19 Vaccinations in the United States, Jurisdiction". CDC COVID -19 Data Tracker (URL: https://data.cdc.gov/Vaccinations/COVID-19-Vaccinations-in-the-United-States-Jurisdi/unsk-b7fc). Check state web sites for additional or more recent information.

Health eMoms: A Novel Platform

Health eMoms
Amplifying the Voices of Colorado Moms

- Unique longitudinal survey project to understand opinions and experiences of Colorado mothers during the first 3 years of their child's life
- Recruits 2400 women annually (2018-2021) from Colorado birth certificates
- Sample mutually exclusive from Pregnancy Risk Assessment Monitoring System (PRAMS)
- Mail recruitment, transition to fully digital platform
  Email/Text Message

Health eMoms

COLORADO
Department of Public Health & Environment

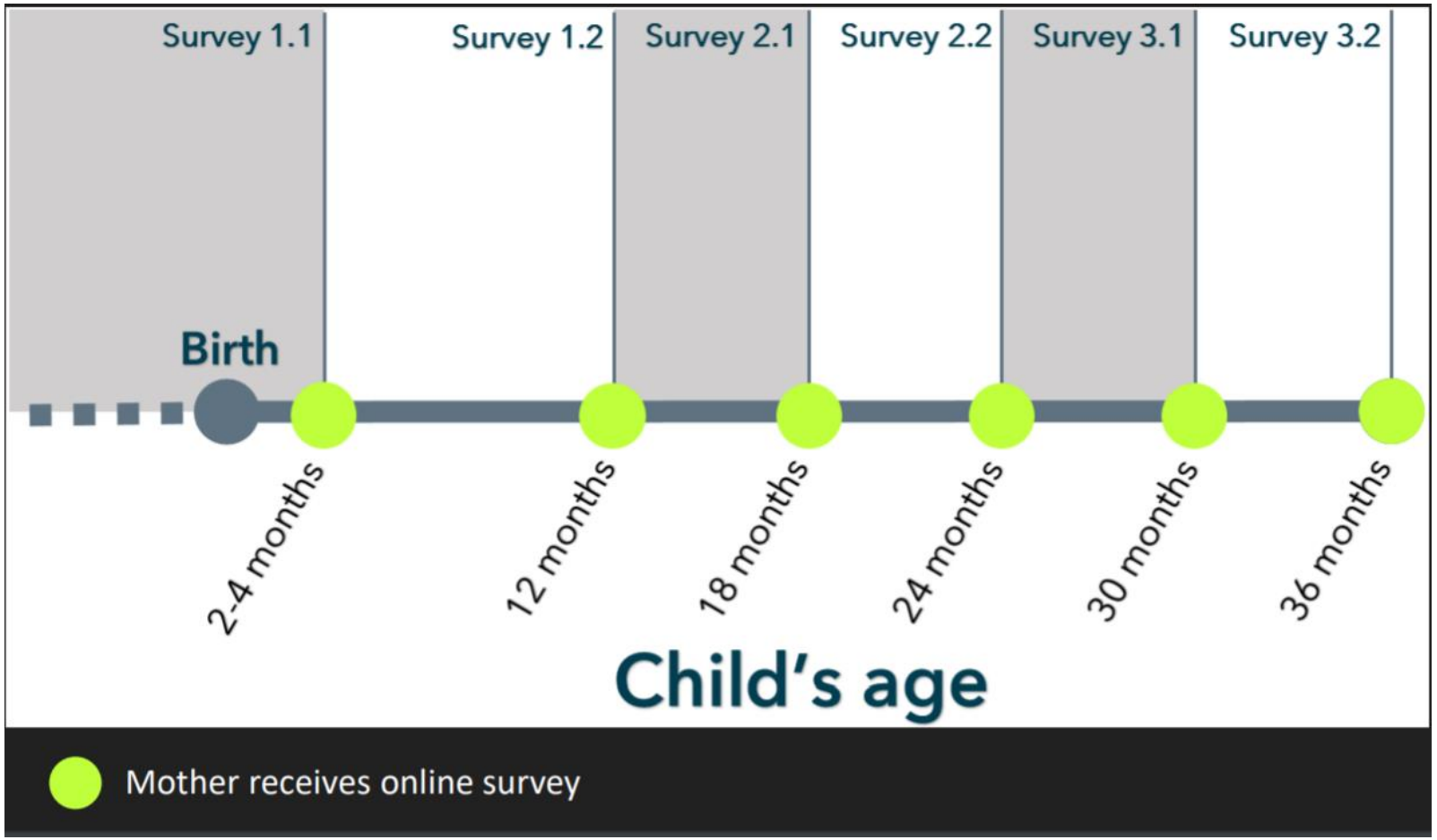
Health eMoms - Survey Topics

- Breastfeeding
- Vaccination
- Maternal Mental Health
- Social and Community Connection
- Paid Leave
- Employment/Family Friendly Practices in the Workplace
- Childcare
- Finance/Resource Insecurity
- Health care Access
- Marijuana and Other Substance Use

Health eMoms

COLORADO
Department of Public Health & Environment

Health eMoms - Survey Timeline



Health eMoms

COLORADO
Department of Public Health & Environment

Health eMoms COVID-19 Cross Sectional Survey

- 2018-2020 Birth Cohorts surveyed
- Survey in field January 20 – February 3, 2021
- Impact of pandemic on housing/food insecurity, childcare, mental health, etc.
- Specific module on COVID-19 vaccination beliefs

Health eMoms

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Prevalence and Predictors of Pediatric Vaccine Acceptance

Study Objectives

- 1) Evaluate maternal COVID-19 vaccine intent for child(ren) and associated predictors of stated intent
- 2) Describe maternal attitudes related to hypothetical COVID-19 vaccination policies
- 3) Summarize themes associated with intention to vaccinate child(ren) for COVID-19

Methods

- Inclusion: all participants currently enrolled in Health eMoms
  Excluded those with missing key demographics or responses of interest

- Health eMoms COVID-19 Survey responses linked with existing Health eMoms demographics

- Primary Outcome: Vaccine intent for child(ren)

  "If COVID-19 vaccines are proven to be safe and effective in children, would you choose to have your child(ren) vaccinated?"

- Secondary Outcomes: Reasons for stated intent, odds of vaccine intent by demographics

Statistical Analysis

- Population statistic survey method to calculated weighted proportions
- Chi-square analysis to compare demographic distributions by COVID-19 vaccine intent
- Two multi-variable models to compare “Yes” vs. “No” and “Yes” vs. “Unsure” responses
- Summarized reasons for stated vaccine intent for child(ren)
- Natural Language Processing to analysis narrative responses
  - Vaccination, mRNA, vaccin-
  - Manual review of included responses and exploration of themes

Respondent Demographics by Vaccine Intent

	Yes, would choose to have child(ren) vaccinated for COVID-19 n (%) 64540 (44.2%)	No, would not choose to have child(ren) vaccinated for COVID-19 n (%) 29618 (20.3%)	Unsure whether to have child(ren) vaccinated for COVID-19 n (%) 51761 (35.5%)	p-value†
Maternal Race and Ethnicity				<0.01
American Indian	683 (34.7%)	55 (27.9%)	736 (37.4%)	
Asian/Pacific Islander	4296 (52.0%)	835 (10.1%)	3128 (37.9%)	
Hispanic	12651 (39.8%)	4989 (15.7%)	13142 (41.1%)	
Non-Hispanic Black	1865 (21.9%)	3189 (37.5%)	3456 (40.6%)	
Non-Hispanic White	42173 (47.3%)	17878 (20.1%)	29113 (32.7%)	
Other	2872 (46.1%)	1176 (18.9%)	2187 (35.1%)	
Maternal Age (at survey)				<0.01
15-19 years	435 (28.0%)	406 (26.1%)	714 (45.9%)	
20-24 years	3508 (20.3%)	5801 (33.6%)	7953 (46.1%)	
25-34 years	34165 (42.7%)	17273 (21.6%)	28594 (35.7%)	
≥35 years	26432 (56.2%)	6138 (13.0%)	14500 (30.8%)	
Maternal Education				<0.01
< High School	4105 (28.2%)	3880 (26.6%)	6595 (45.2%)	
High School	7771 (26.9%)	9240 (31.9%)	11932 (41.2%)	
>High School	52667 (51.4%)	16499 (16.1%)	33233 (32.5%)	
Child Insurance				<0.01
Private	42909 (58.0%)	9032 (12.2%)	22044 (29.8%)	
Public	20402 (29.8%)	19365 (28.3%)	28655 (41.9%)	
Other	508 (27.3%)	967 (51.9%)	387 (20.8%)	
None	721 (43.7%)	253 (15.4%)	676 (41.0%)	

Bourque SL, Weikel BW, Cataldi JC, Blackwell S, Hwang SS. Am J Perinatol, 2022.

† p-value represents chi-square comparison across yes, no, and unsure responses

Respondent Demographics by Vaccine Intent

		Yes, would choose to have child(ren) vaccinated for COVID-19 n (%) 64540 (44.2%)	No, would not choose to have child(ren) vaccinated for COVID-19 n (%) 29618 (20.3%)	Unsure whether to have child(ren) vaccinated for COVID-19 n (%) 51761 (35.5%)	p-value†
Primary Language					<0.01
	English	60149 (43.8%)	28578 (20.8%)	48653 (35.4%)	
	Spanish	4391 (51.4%)	1040 (12.2%)	3109 (36.4%)	
Geographic Location					<0.01
	Denver Metro	43865 (54.1%)	12044 (14.7%)	25437 (31.2%)	
	Other Metro	15531 (32.5%)	12468 (26.0%)	19895 (41.5%)	
	Rural	5144 (30.0%)	5409 (31.5%)	6611 (38.5%)	
Early Childhood Vaccine Approach					<0.01
	According to Schedule	61987 (47.9%)	21971 (17.0%)	45512 (35.2%)	
	Delaying/Avoiding Vaccines	2348 (18.6%)	5059 (40.0%)	5234 (41.4%)	
	Not Vaccinating	204 (5.4%)	2588 (68.0%)	1014 (26.7%)	

† p-value represents chi-square comparison across yes, no, and unsure responses

Odds of COVID-19 Vaccine Intent for Child(ren) by Demographics

	Yes vs. No aOR (95% CI)
Maternal Race/Ethnicity	
American Indian	1.38 (0.48, 3.93)
Asian/Pacific Islander	3.41 (0.62, 18.88)
Hispanic	4.41 (0.86, 2.31)
Non-Hispanic Black	**0.26 (0.13, 0.54)**
Non-Hispanic White	REF
Other	1.31 (0.50, 3.43)
Maternal Age (at survey)	
15-19 years	1.52 (0.09, 26.44)
20-24 years	0.69 (0.37, 1.27)
25-34 years	REF
≥35 years	**1.87 (1.27, 2.74)**
Maternal Education	
< High School	**0.26 (0.12, 0.56)**
High School	**0.36 (0.23, 0.59)**
>High School	REF

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Odds of COVID-19 Vaccine Intent for Child(ren) by Demographics

		Yes vs. No aOR (95% CI)
Primary Language		
	English	REF
	Spanish	**5.58 (1.79, 17.42)**
Child Insurance		
	Private	REF
	Public	**0.43 (0.30, 0.63)**
	Other	**0.17 (0.07, 0.46)**
	None	3.36 (0.34, 32.83)
Geographic Location		
	Denver Metro	REF
	Other Metro	**0.39 (0.27, 0.57)**
	Rural	**0.28 (0.16, 0.48)**
Early Childhood Vaccine Approach		
	According to Schedule	REF
	Delaying/Avoiding Vaccines	**0.16 (0.09, 0.28)**
	Not Vaccinating	**0.02 (0.01, 0.07)**

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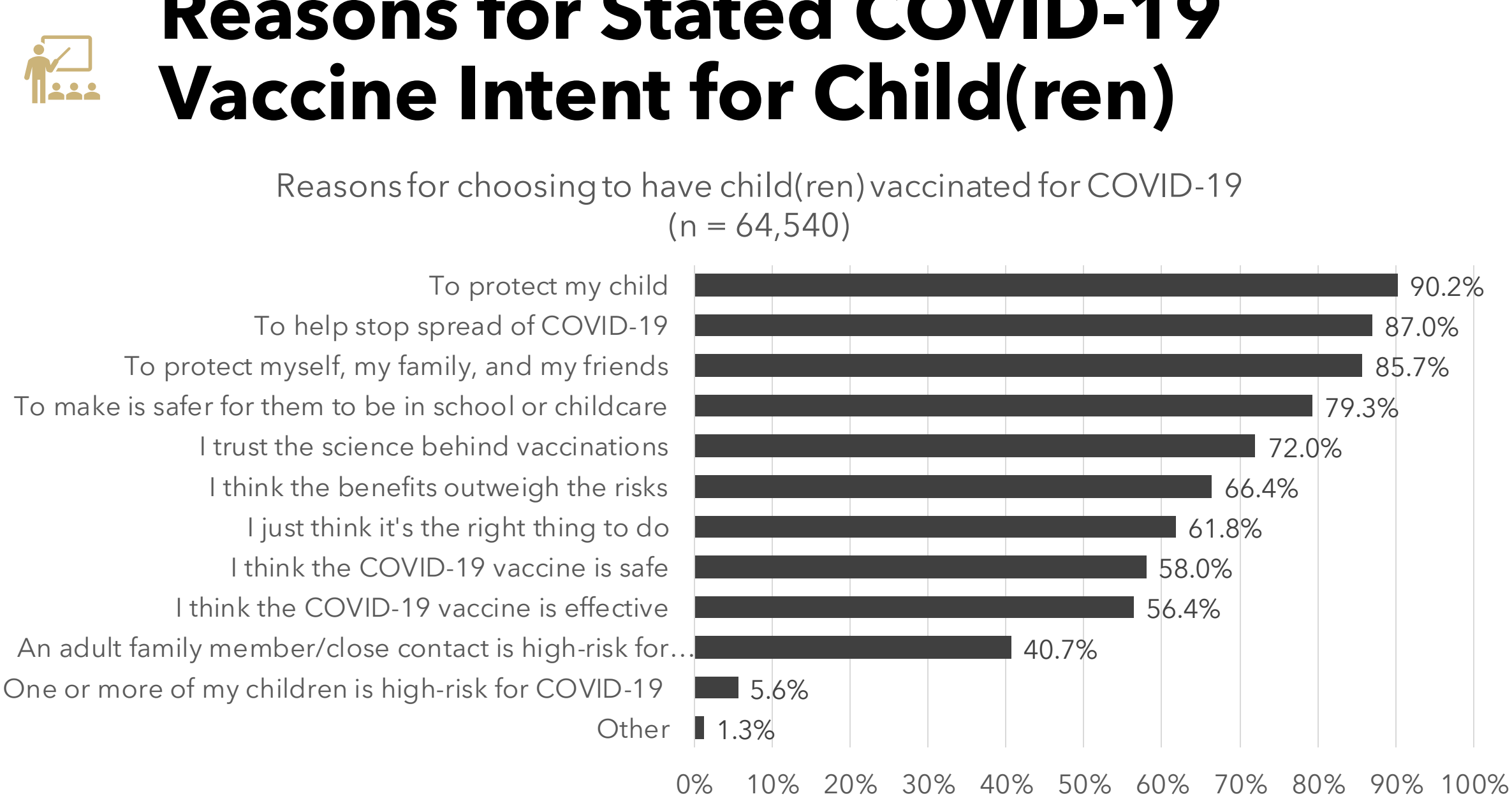
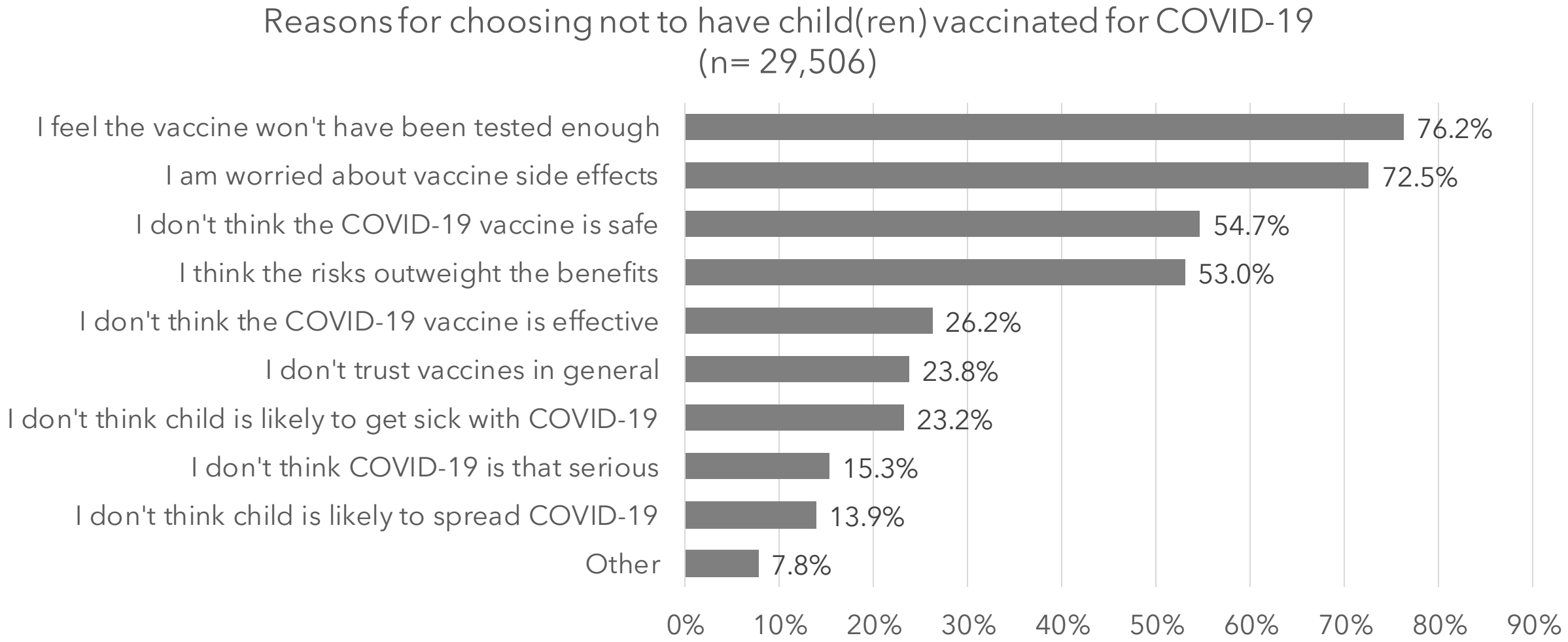
Reasons for Stated COVID-19 Vaccine Intent for Child(ren)



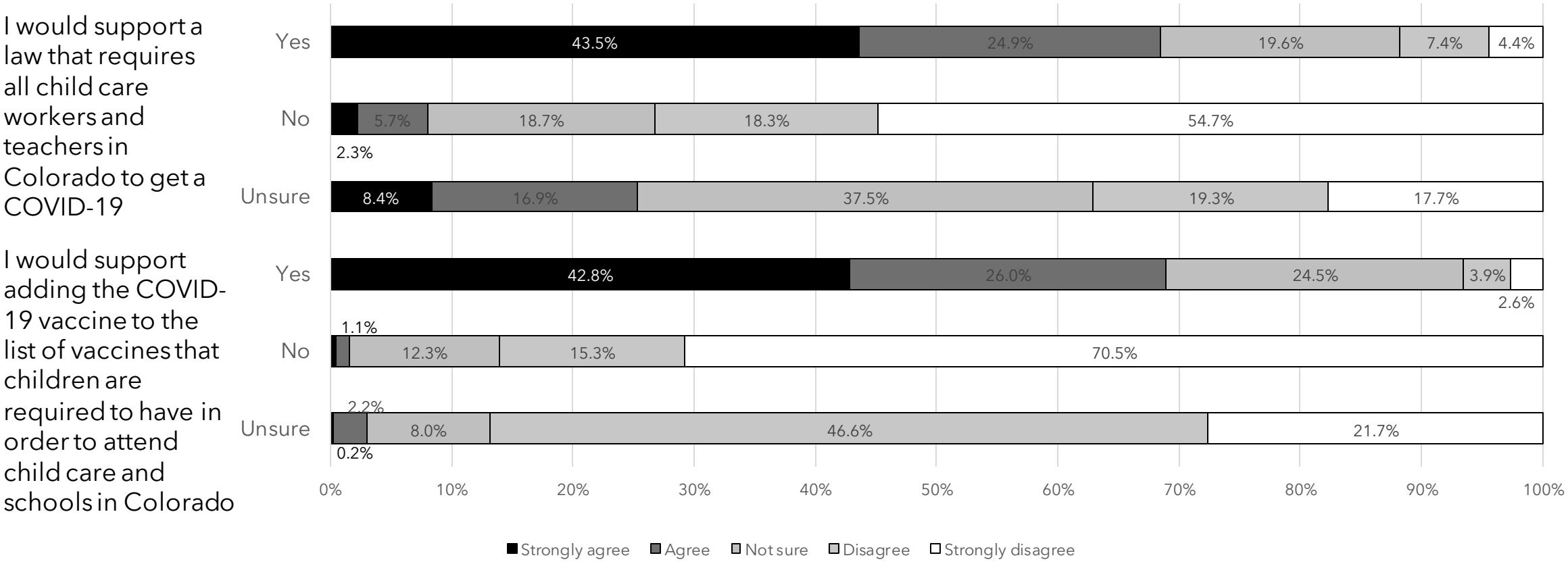
‡ Respondents could select more than one response and percentages may not sum to 100

Reasons for Stated COVID-19 Vaccine Intent for Child(ren)



‡ Respondents could select more than one response and percentages may not sum to 100

Attitudes Towards Hypothetical COVID-19 Policies by Vaccine Intent



COVID-19 Vaccine Related Comments by Theme

Vaccine Approval and Recommendations	If the vaccine were approved for children <16, I would consider getting it for my children.
	It has not been tested on children, therefore I will not allow my child to get it if it became available, until I see effective and efficient research and FDA approval for his age group.
	If it's suggested that I give my child the vaccine, I will do it despite my reservations. Anything to keep everyone safe.
Vaccine Timing and Implementation	[child name] is fully vaccinated but I would wait a few years, so we know the side effects from the COVID vaccine.
	I will not vaccinate my kids for COVID until there is more data and research backed up with years of positive vaccine results.
Vaccine Mandate	While I believe very strongly in science and vaccines, I don't think we have the right to impose it and require it of others.
	I respect others decisions regarding the new COVID vaccine. I do not believe anyone should be forced to receive the vaccine because it is so new and scary. However, I do believe in vaccines.
	I think the requirement for the COVID vaccine to attend school should have a medical exemption only.
	I will personally move to a different state if vaccines become mandated, especially the COVID vaccine.

Study Conclusions

- >50% do not intend or are unsure of whether to pursue COVID-19 vaccination for their child(ren)

- Association with several demographic and social factors with vaccine acceptance vs. hesitancy

- Current opportunities for perinatal, pediatric providers and public health organizations to educate and inform pregnant people and families of young children
  - Focus on addressing vaccine safety and efficacy concerns

Perinatal Vaccine Education

Vaccine Education During Pregnancy

- 75% planned to have child vaccinated according to schedule
- Women planning to delay or opt out of vaccinations were more likely to rely on internet search engines for information
- <50% of those who received information from their healthcare professional were 'very satisfied'

Top Sources for childhood vaccine information.

In the past month, what were your 3 most important sources of information about childhood vaccines?	%[a]
Internet search engines (e.g., Google, Yahoo)	36.0
Family	27.0
My healthcare professional (such as a primary care professional or OB/GYN)	22.5
Online pregnancy or parenting site (e.g., BabyCenter or The Bump)	19.0
Friends	17.0
Internet health site	13.5
My child's doctor	9.5
My child's other parent	7.5
Internet social media (e.g., Facebook, Twitter, message boards)	4.5
Internet news site	3.5
Parenting blogs	3.5
Apps (for smartphones or tablets)	3.0
Other source(s) (not Internet)	2.5
Traditional media (such as television, newspapers, radio, magazines, and books)	1.5
Other Internet sources	1.5
My child's nurse	1.0
Complementary healthcare professional (such as chiropractor or homeopath)	1.0

Weiner, *et al*. Vaccine, 2015.

Parental Trust

- Mixed Methods study of Kaiser Permanente Colorado parents

- Themes from focus groups with vaccine-hesitant parents

Vaccine decision-making process begins prenatally

Vaccine decision making is an evolving process

Overall trust in pediatrician, but lack of trust in vaccine related information

- Survey of parents who accepted, delayed or refused vaccinations
  - Those who refuse or delay vaccines are 2x more likely to report thinking about vaccines before child was born
  - 8x more likely to report they constantly reevaluate their vaccine decisions

Glanz, *et al. Academic Pediatr*, 2013.


MCI
POWER

Acknowledgments

- Sarah Blackwell, MPH – Health eMoms Program Manager
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- Claire Palmer, MS


Thank You