



## Homeschooling parents in California: Attitudes, beliefs and behaviors associated with child's vaccination status

Salini Mohanty<sup>a</sup>, Caroline M. Joyce<sup>a</sup>, Paul L. Delamater<sup>b</sup>, Nicola P. Klein<sup>c</sup>, Daniel Salmon<sup>d</sup>, Saad B. Omer<sup>e,f,g</sup>, Alison M. Bутtenheim<sup>a,h,\*</sup>

<sup>a</sup> Department of Family and Community Health, University of Pennsylvania School of Nursing, Philadelphia, PA, United States

<sup>b</sup> Department of Geography and Carolina Population Center, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States

<sup>c</sup> Kaiser Permanente Vaccine Study Center, Oakland, CA, United States

<sup>d</sup> Departments of International Health and Health Behavior Society, Institute for Vaccine Safety, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, United States

<sup>e</sup> Yale Institute for Global Health, Yale University, New Haven, CT, United States

<sup>f</sup> Department of Medicine, Infectious Diseases, Yale University School of Medicine, New Haven, CT, United States

<sup>g</sup> Department of Epidemiology of Microbial Diseases, Yale School of Public Health, Yale University, New Haven, CT, United States

<sup>h</sup> Center for Health Incentives and Behavioral Economics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States

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### ABSTRACT

**Background:** Senate Bill 277 (SB277) banned nonmedical exemptions from school-entry vaccination requirements for children attending classroom-based schools in California, but excluded homeschooled children from vaccination requirements. Thus, it was hypothesized that more parents would choose to homeschool to avoid vaccination requirements in response to SB277. There is limited literature on the vaccine attitudes, beliefs, and behaviors among the homeschooling population in the US, despite an overall increase in homeschooling nationwide and documented vaccine-preventable disease outbreaks within the homeschooled child population.

**Methods:** Between November 2018 and January 2019, we conducted a cross-sectional online survey among homeschooling parents with at least one child in grades K-8 who is currently enrolled in one of the legally-acceptable mechanisms to homeschool in California: (1) home-based private school satellite program (PSP), or (2) public or charter independent study program (ISP) with no classroom-based instruction.

**Results:** Among 140 homeschooling parents from 8 schools in California, 71% reported that their youngest child in grade K-8 was up-to-date on immunizations at kindergarten-entry and 56% reported that they made the decision to homeschool their child after the implementation of SB277. Compared to homeschooling parents whose child was up-to-date at kindergarten entry, homeschooling parents whose child was not up-to-date at kindergarten entry reported higher concerns over vaccine safety and effectiveness, more frequently cited immunization mandates as a reason to homeschool, and were more likely to report having considered moving out of California due to immunization mandates.

**Conclusion:** There was variation in vaccine attitudes and beliefs within the homeschooling population in this sample. Immunization mandates were a factor in the decision to homeschool for some parents in this sample, supporting the hypothesis that vaccine-hesitant parents considered homeschooling as a way to avoid immunization mandates such as SB277. Future studies should explore the complexities around vaccine attitudes, beliefs and behaviors among homeschooling populations.

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**Abbreviations:** VPD, vaccine-preventable disease; PSP, private school satellite program; ISP, independent study program; PSA, private school affidavit; SB277, Senate Bill 277; CDE, California Department of Education; PACV, Parent Attitudes about Childhood Vaccines; IEP, individualized education program; UTD, up-to-date; NUTD, not up-to-date; CDC, Centers for Disease Control and Prevention.

\* Corresponding author at: Department of Family and Community Health, University of Pennsylvania School of Nursing, 418 Curie Blvd, Philadelphia, PA 19104, United States.

E-mail addresses: [smohanty@upenn.edu](mailto:smohanty@upenn.edu) (S. Mohanty), [abutt@nursing.upenn.edu](mailto:abutt@nursing.upenn.edu) (A.M. Bутtenheim).

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### 1. Introduction

The estimated percentage of homeschooled students in the United States has increased from 1.7 percent in 1999 (850,000) to 3.3 percent in 2016 (1.7 million) [1]. Generally, homeschooled children are more likely to be white, live in households with three or more children, and reside in rural areas [1]. Although knowledge about vaccine-related attitudes, beliefs, and behaviors among

homeschooling parents is limited [2–7], studies have shown that homeschooling parents have less favorable views of vaccines and vaccine mandates than parents of children in public and private schools [2,8,9]. Vaccine-preventable disease (VPD) outbreaks have also been documented in homeschooled populations [10,11].

Parents are motivated to homeschool by concerns about school environment (safety, drugs, negative peer pressure) and by a desire to provide religious and moral instruction [12]. Avoiding school vaccine mandates may be another motivation. In all 50 states, children must be vaccinated or obtain an exemption for school-entry [13]. However, vaccination requirements and levels of regulation and monitoring vary substantially for homeschooled children [14]. Some states require no contact with the state to set up a homeschool, making it difficult to track compliance with vaccination requirements, while other states require parents to register the school, but do not require additional follow-up regarding vaccination status [5]. In states where nonmedical exemptions are difficult to obtain or not available, parents may choose to homeschool to avoid school-entry mandates [15–17].

In California, state law requires that children ages six through eighteen attend school [18]. There are three options for homeschooling that meet this legal requirement [19]: (1) home-based private school satellite program (PSP), (2) public or charter independent study program (ISP) with no classroom-based instruction, and (3) private school affidavit (PSA). A PSP is a private school with an affidavit in which a parent serves as the child's teacher, but the parents name and address does not appear on the affidavit. Instead, an administrator/director of the PSP ensures parents are compliant with requirements including school records and course of study. Parents who enroll their children in a PSP pay for all books and learning materials [20]. An ISP is a public school program where the parent is considered a teacher aide and a credentialed teacher is assigned to oversee the ISP program. In an ISP program the state pays for curriculum, supplies, and classes outside of the home. ISPs may be located at charter or non-charter public schools [19]. Parents can file a PSA to operate their own private school where they are required to keep records and answer inquiries regarding their school. Parents who operate a PSA have their name and address listed on the affidavit. Parents who file a PSA are required to teach certain subjects like math, science, social studies via state mandates, but they are given more freedom in deciding which specific topics are covered and how they cover them [19].

Effective in July 2016, California eliminated nonmedical exemptions from school-entry vaccination requirements. Under Senate Bill 277 (SB277), only students with a medical exemption or those receiving instruction in a home-based private school or an ISP without classroom-based instruction are excluded from school vaccine-mandates [21]. An increase in homeschooling was identified as a potential consequence of SB277's implementation for vaccine-hesitant parents [22]. This study adds to the limited literature on vaccine-related attitudes, beliefs, and behaviors among homeschooling parents.

## 2. Methods

### 2.1. Sample

This sample included parents in California who use two of the three legal options for homeschooling: (1) PSP, and (2) ISP. We did not include the third option, PSA, in our sampling frame because the California Department of Education (CDE) excludes private schools with fewer than 6 students from publicly-available databases. Parents were eligible to participate in the study if they had at least one child in grades K-8 enrolled in a PSP or ISP.

Through an internet search in October 2018 we identified and compiled a list of PSPs. Search terms included “California PSP” and “Private School Satellite Programs California”. We confirmed that schools identified in the search were in fact PSPs by contacting schools directly and only PSP-confirmed schools were approached to participate in the survey. In order to identify ISP programs, we started with a publicly-available list of all public schools from the CDE [23], and restricted our school sample to schools that were actively open, served grades K-8 and provided virtual instruction “primarily” or “exclusively”. Virtual instruction is defined as instruction where students and teachers are separated by time and/or location and the interaction occurs via computers and/or telecommunications technologies [24]. “Primarily” virtual means that students have some physical meetings with other students or teachers; “exclusively” virtual means that all instruction is virtual with no physical buildings where students and teachers congregated [24].

#### 2.1.1. Survey administration

After compiling a list of ISPs and PSPs, we reached out to each school to invite their parents to participate in the survey. Between November 2018 and January 2019, we conducted an online survey among the ISP and PSP schools that agreed to participate using the web-based software Qualtrics™ (Provo, UT). The survey was pilot-tested with five homeschooling parents in California prior to survey administration. Each participating school sent an email invitation to eligible parents explaining the purpose of the study and included an URL link to the survey. Parents were eligible for \$5 USD gift card as an incentive for participation. Since the survey was voluntary and anonymous, schools were asked to provide the number of families to whom the survey link was sent to in order to calculate school-specific response rates. Participants were informed that clicking through to the start of the survey constituted consent. The Institutional Review Board of Emory University approved this study.

We identified 54 possible PSPs through our search. Of those 54 schools, 4 were closed, 5 were excluded because the schools were not actually PSPs, and 13 could not be contacted. Among the remaining 32 confirmed PSPs, 3 agreed to participate, 4 declined to participate, and 24 could not be contacted despite multiple repeated phone calls and emails. A total of 18 parents from the three PSP schools attempted the survey.

Of the 104 eligible ISP schools, 7 schools agreed to participate (of which 6 distributed the survey to parents), 13 declined to participate, 4 were excluded due to the students not meeting ISP criteria, and 80 could not be contacted despite multiple attempts. A total of 145 parents from the six ISP schools attempted the survey.

Overall, 9 schools sent the survey to parents, including 3 of 32 PSPs (9%) and 6 of 100 ISPs (6%). The parental survey response rate was 15% (163/1085) and the school-level response rate was 7% (9/132). The 9 schools that agreed to participate were located in the following counties: Fresno, San Diego, Los Angeles, Riverside, Kings, San Bernardino, and Solano. The number of K-8 students in participating schools ranged from 15 to 464 students (median = 49). School-level parental response rates ranged from 5 to 47%. We excluded 23 responses due to missing data on homeschooling history. As a result of exclusions, one school's responses were not included in the final sample. The final sample included 140 parents from 8 schools.

### 2.2. Measures

#### 2.2.1. Demographics & homeschooling history

The survey included questions regarding the participant's relationship to homeschooled children in the household, race/ethnicity, age, educational attainment, total family income, number of

children currently enrolled in grades K-8, the number of children currently being homeschooled in grades K-8, and the primary and secondary reason for choosing to homeschool each child. We combined all responses to report the most commonly-cited reasons for homeschooling as respondents could choose multiple reasons per child. For each child in grades K-8, parents provided information including current grade, if the child had ever been homeschooled, whether the child was currently homeschooled, and what grade the child started homeschooling, if at all.

#### 2.2.2. Health care & health behaviors

Parents were asked to provide information about their youngest homeschooled child in grades K-8 which we referred to as the “focal child”. We measured health care and health-related behaviors for their focal child, including child’s primary care provider type, how strongly their child’s provider recommended vaccination, and use of alternative medicines.

#### 2.2.3. Vaccine attitudes, beliefs and behaviors

Parents reported vaccination status at the time of kindergarten-entry, including up-to-date on all required vaccinations, temporary or permanent medical exemption, conditional admission, having a personal belief exemption before 2016, or none of the above due to homeschooling. We dichotomized vaccination status into up-to-date and not up-to-date (all other categories).

Vaccine attitudes and beliefs were measured using the Parent Attitudes about Childhood Vaccines (PACV), a reliable and valid measure that identifies parents who are vaccine-hesitant [25–27]. The PACV short scale includes 5 items measured on a 3-point scale (Yes, No and Don’t Know), within 3 categories including behavior, safety and efficacy, and general attitudes. The PACV short scale questions are each scored on a 0–2 scale, with a summary score ranging between 0 and 10. Higher PACV summary scores are associated with increased parental vaccine hesitancy. We also included four questions on concerns about vaccine safety and effectiveness, and vaccine requirements for school-entry that we have used in prior studies [28,29].

#### 2.2.4. Knowledge and attitudes about California immunization laws

We asked parents if they were aware of California’s vaccination requirements for school-entry, whether these laws influenced their decision to vaccinate their children, what the vaccination status of their focal child would be without vaccination requirements, and whether they were aware of SB277. With respect to California laws and vaccinating their focal child for school-entry, parents were asked to report whether they had considered any of the following: permanent medical exemption, moving out of California, getting an individualized education program (IEP), homeschooling, or other reasons. Among parents who were aware of SB277, we also asked how they learned about the law (media, social media, school, doctor, etc.). Respondents could choose multiple responses for all of these questions.

### 2.3. Statistical analysis

We compared responses based on parental reported vaccine status for the focal child at kindergarten-entry (up-to-date vs. not up-to-date). Chi-square analyses were used to assess statistically significant differences ( $p < 0.05$ ) in demographics, health care behaviors, vaccine attitudes, and knowledge about California immunization laws. All analyses were conducted using RStudio Version 1.1.456.

## 3. Results

### 3.1. Demographics & homeschooling history

The majority of the sample were mothers (93%), identified as white (51%), were between 36 and 45 years old (44%), completed some college/had a college degree (66%), and had a total family income of \$30,000 to \$99,000 (44%). The most commonly reported reasons for homeschooling were concerns about the school environment (60%) and dissatisfaction with academic instruction at other schools (49%). Almost 3 in 4 homeschooling parents reported that their focal child was up-to-date (UTD) on vaccines upon kindergarten-entry (71%), and a majority made the decision to homeschool their focal child after the passage of SB277 (56%). A higher percentage of not up-to-date (NUTD) parents reported that California immunization mandates were a reason they chose to homeschool compared to the UTD subgroup (34% vs. 3%,  $p < 0.001$ ) (Table 1).

### 3.2. Health care & health behaviors

The majority of parents reported that a doctor/physician was their focal child’s primary care provider (82%); however, the NUTD subgroup reported lower percentages of having a doctor/physician as their focal child’s primary care provider (68% vs. 87%,  $p = 0.04$ ) compared to the UTD subgroup. A higher proportion of the NUTD subgroup also reported using alternative medicine (63% vs. 46%,  $p$ -value =  $< 0.01$ ) compared to the UTD subgroup. The majority of homeschooling parents (69%) reported that their focal child’s doctor strongly recommended vaccines (Table 2).

### 3.3. Vaccine attitudes and beliefs

The NUTD subgroup reported being more concerned than the UTD subgroup that children’s immune systems could be weakened by too many immunizations (64% vs. 17%,  $p < 0.001$ ) and that the Centers for Disease Control and Prevention (CDC) underestimates the frequency of side effects of vaccines (73% vs. 40%,  $p < 0.001$ ). The NUTD subgroup was also more likely to believe that parents should be allowed to send their children to school even if not vaccinated (71% vs. 31%,  $p < 0.001$ ). In contrast, the UTD subgroup was more likely to strongly agree or agree that immunization requirements protect children from getting a disease from unimmunized children (57% vs. 17%,  $p$ -value  $< 0.01$ ). When asked if there were no laws requiring immunizations for school-entry in California, the majority of the UTD subgroup reported that their focal child would be up-to-date on all vaccines (72%) compared to 10% among the NUTD subgroup ( $p < 0.01$ ); instead the NUTD subgroup reported that their child would be partially vaccinated (27%) or unvaccinated (56%). PACV scores among the NUTD subgroup were higher (73% vs. 27%,  $p < 0.001$ ) compared to the UTD subgroup, reflecting increased vaccine hesitancy (Table 3).

### 3.4. Knowledge and attitudes about California immunization laws

While awareness of California laws related to school-entry vaccine mandates was high generally, the NUTD subgroup reported being less aware of these laws (83% vs. 93%,  $p$ -value =  $< 0.01$ ) and less likely to be influenced by these laws in deciding to vaccinate their youngest homeschooled child (10% vs. 26%,  $p$ -value = 0.04) compared to the UTD subgroup. Contemplating an out-of-state move was reported more frequently among the NUTD subgroup compared to the UTD subgroup (39% vs 5%,  $p$ -value = 0.02). Most parents were aware of SB277 (56%) and learned about SB277

**Table 1**  
Characteristics of homeschooling parents.

	Total sample 140 (100%)	Not up-to-date 41 (29%)	Up-to-date 99 (71%)	p-value
School Type				0.81
Private School Satellite (PSP) N = 3 schools	15 (11)	4 (10)	11 (11)	
Independent Study Program (ISP) N = 5 schools	125 (89)	37(90)	88 (89)	
Started Schooling				0.81
Before SB277	61 (44)	19 (46)	42 (42)	
After SB277	79 (56)	22 (54)	57 (58)	
Respondent				0.92
Mother	130 (93)	36 (88)	94 (95)	
Father	8 (6)	4 (10)	4 (4)	
Other	2 (1)	1 (2)	1 (1)	
Race/Ethnicity				0.84
White, non-Hispanic	71 (51)	23 (56)	48 (49)	
Hispanic	32 (22)	8 (20)	24 (24)	
Black, non-Hispanic	8 (6)	3 (7)	5 (5)	
Asian/Pacific Islander	16 (12)	4 (10)	12 (12)	
Native American	3 (2)	0 (0)	3 (3)	
Other/Prefer not to Answer	10 (7)	3 (7)	7 (7)	
Age				0.29
18–25 years	7 (5)	2 (5)	5 (5)	
26–35 years	43 (31)	13 (32)	30 (30)	
36–45 years	62 (44)	19 (46)	43 (44)	
46–55 years	23 (17)	6 (15)	17 (17)	
56–60 years	1 (0.7)	0 (0)	1 (1)	
61 years or older	3 (2)	1 (2)	2 (2)	
Did not answer	1 (0.7)	0 (0)	1 (1)	
Education-Level				0.22
Some high school, High school graduate, or GED certificate	12 (9)	3 (7)	9 (9)	
Some college, College graduate	93 (66)	31 (76)	62 (63)	
Post-graduate	28 (20)	4 (10)	24 (24)	
Decline to answer	7 (5)	3 (7)	4 (4)	
Total Family Income				0.32
Under \$30,000	18 (13)	8 (19)	10 (10)	
\$30,000–\$99,999	62 (44)	18 (44)	44 (45)	
Over \$100,000	46 (33)	11 (27)	35 (35)	
Don't Know/Decline to Answer	14 (10)	4 (10)	10 (10)	
Number of children currently enrolled in grades K through 8				0.96
1	78 (56)	23 (56)	55 (56)	
2	36 (26)	11 (27)	25 (25)	
3	10 (7)	3 (7)	7 (7)	
4	5 (4)	1 (2)	4 (4)	
5	2 (1)	1 (2)	1 (1)	
6	0 (0)	0 (0)	0 (0)	
Did not answer	9 (6)	2 (5)	7 (7)	
Average number of children being homeschooled per family	1.59	1.61	1.58	0.88
Most Commonly Cited Reason for Homeschooling				
Concerns about environment of schools	84 (60)	21 (51)	63 (64)	<0.01
To provide religious or moral instruction	42 (30)	9 (22)	33 (33)	<0.01
Dissatisfaction with academic instruction at other schools	68 (49)	18 (43)	50 (50)	<0.01
Child has a physical or mental health problem	7 (5)	4 (10)	3 (3)	0.71
Child has other special needs	14 (10)	2 (5)	12 (12)	<0.01
California immunization mandates	17 (12)	14 (34)	3 (3)	<0.01
Other	35 (25)	11 (27)	24 (24)	0.03

through the media (26%), social media (26%) and friends, neighbors, relatives (26%) (Table 4).

#### 4. Discussion

The increasing number of families choosing to homeschool nationwide, differences in vaccination requirements for homeschooled children, and VPD outbreaks in homeschooled populations has made this population of homeschoolers an interest to public health researchers and practitioners. A small number of studies have reported diverse vaccine attitudes and beliefs among homeschooling parents [3,7]. While some studies have reported increased concerns among homeschooling parents regarding vaccine safety and efficacy compared to private and public schools

[2,9], other studies have shown that homeschooling parents are generally supportive of vaccines [3,9]. In this sample of homeschooling parents, the NUTD subgroup reported higher levels of concerns of vaccine safety and effectiveness and increased vaccine hesitancy compared to the UTD subgroup. There was variation in vaccine-related attitudes, beliefs and decision-making among this sample of homeschooling parents suggesting that homeschooling parent's vaccine attitudes and beliefs are more heterogeneous than previously reported.

In response to SB277, parents who wanted to avoid the new vaccination mandates had limited options – obtain a medical exemption for their child, choose homeschooling or an independent study program, or leave California. Parents in this sample reported that they considered homeschooling (30%), moving out

**Table 2**  
Health care and health behaviors.

	Total Sample 140 (100%)	Not up-to-date 41 (29%)	Up-to-date 99 (71%)	p-value
Who do you consider to be your child's primary doctor?				
Doctor/physician	114 (82)	28 (68)	86 (87)	0.04
Physician Assistant	5 (4)	2 (5)	3 (3)	
Nurse	0 (0)	0 (0)	0 (0)	
Nurse Practitioner	7 (5)	4 (10)	3 (3)	
Chiropractor	2 (1)	2 (5)	0 (0)	
Homeopathic Doctor	2 (1)	1 (2)	1 (1)	
Other/Did Not Answer	10 (7)	4 (10)	6 (6)	
Use of Alternative Medicine (chiropractor, acupuncturist, etc.)				<0.01
Yes	72 (51)	26 (63)	46 (46)	
No	57 (41)	9 (22)	48 (49)	
Don't Know/ Did Not Answer	11 (8)	6 (15)	5 (5)	
How strongly did your child's doctor recommend vaccinations?				0.09
Extremely Strongly for Vaccination	55 (40)	11 (37)	44 (42)	
Somewhat Strongly for Vaccination	41 (29)	12 (28)	29 (29)	
Neutral	30 (22)	12 (18)	18 (24)	
Somewhat Strongly against Vaccination	2 (1)	1 (3)	1 (0)	
Extremely Strongly against Vaccination	2 (1)	2 (3)	0 (0)	
Don't Know	10 (4)	3 (5)	7 (3)	

**Table 3**  
Vaccine attitudes and beliefs.

	Total Sample 140 (100%)	Not up-to-date 41 (29%)	Up-to-date 99 (71%)	p-value
I am concerned that children's immune systems could be weakened by too many immunizations				<0.01
Strongly Agree	18 (13)	11 (27)	7 (7)	
Agree	25 (17)	15 (37)	10 (10)	
Neither Agree nor Disagree	34 (24)	9 (22)	25 (25)	
Disagree	25 (18)	2 (5)	23 (23)	
Strongly Disagree	19 (14)	3 (7)	16 (16)	
Don't Know/ Did Not Answer	19 (14)	1 (2)	18 (19)	
Immunization requirements protect children from getting diseases from unimmunized children				<0.01
Strongly Agree	22 (16)	1 (2)	21 (21)	
Agree	41 (29)	6 (15)	35 (36)	
Neither Agree nor Disagree	25 (18)	9 (22)	16 (16)	
Disagree	13 (9)	10 (24)	3 (3)	
Strongly Disagree	19 (14)	13 (32)	6 (6)	
Don't Know/ Did Not Answer	20 (14)	2 (5)	18 (18)	
Parents should be allowed to send their children to school even if not vaccinated				<0.01
Strongly Agree	22 (16)	14 (34)	8 (8)	
Agree	38 (27)	15 (37)	23 (23)	
Neither Agree nor Disagree	21 (15)	4 (10)	17 (17)	
Disagree	32 (23)	3 (7)	29 (30)	
Strongly Disagree	11 (8)	2 (5)	9 (9)	
Don't Know/ Did Not Answer	16 (11)	3 (7)	13 (13)	
I am concerned that the CDC/ACIP underestimates the frequency of side effects				<0.01
Strongly Agree	37 (26)	19 (46)	18 (18)	
Agree	33 (24)	11 (27)	22 (22)	
Neither Agree nor Disagree	30 (21)	2 (5)	28 (29)	
Disagree	8 (6)	1 (2)	7 (7)	
Strongly Disagree	8 (6)	4 (10)	4 (4)	
Don't Know/ Did Not Answer	24 (17)	4 (10)	20 (20)	
Parental Attitudes about Childhood Vaccines (PACV)				<0.01
Low (0–4)	62 (44)	5 (12)	57 (58)	
Medium (5–6)	21 (15)	6 (15)	15 (15)	
High (7–10)	57 (41)	30 (73)	27 (27)	

of California (15%) and/or getting a permanent medical exemption (15%) in response to California's laws to vaccinate their focal child for school-entry. Higher proportions of parents whose focal child was not up-to-date on immunizations considered moving out of California as a response to SB277 than parents whose focal child was up-to-date. Similarly, the NUTD subgroup more often reported that California immunization laws were an important reason they choose to homeschool. This suggests that some vaccine hesitant parents did consider laws like SB277 when making the decision to homeschool and some homeschooling parents considered seek-

ing residency outside of California in response to SB277. Compared to a qualitative study of 24 homeschooling parents in California that found that SB277 did not impact their decision to vaccinate or their decision to homeschool [3], this study showed that immunization mandates did play a part in the decision to homeschool and that vaccine-hesitant parents considered this option more so than parents whose focal child was up-to-date on vaccines. However, our study echoes the qualitative study in that we found that there is variation in vaccine attitudes, beliefs and behaviors among the homeschooling population in California [3].



**Table 4**

Knowledge and attitudes of California immunization laws and Senate Bill 277 (SB277).

	Total Sample 140 (100%)	Not up-to-date 41 (29%)	Up-to-date 99 (71%)	p-value
Awareness of California laws that require children to be vaccinated for school				<0.01
Yes	126 (90)	34 (83)	92 (93)	
No	5 (4)	5 (12)	0 (0)	
Don't Know	9 (6)	2 (5)	7 (7)	
Did these laws influence your decision to vaccinate your youngest homeschooled child				0.04
Yes	30 (22)	4 (10)	26 (26)	
No	104 (74)	34 (83)	70 (71)	
Don't Know	6 (4)	3 (7)	3 (3)	
Did you consider any of the following as a result of California laws to vaccinate your youngest homeschooled child for school-entry (mark all that apply)				
Permanent Medical Exemption (PME)	21 (15)	12 (30)	9 (9)	<0.01
Moving out of California	21 (15)	16 (39)	5 (5)	<0.01
Getting an Individualized Education Program (IEP)	4 (3)	3 (7)	1 (1)	0.14
Homeschooling	42 (30)	25 (61)	17 (17)	<0.01
Other	8 (6)	4 (10)	4 (4)	0.35
I did not consider any of these	74 (53)	3 (7)	71 (72)	<0.01
If there no laws requiring vaccines for school-entry in California, what would the vaccination status of your youngest homeschooled child be				<0.01
Up-to-date on all vaccines	75 (54)	4 (10)	71 (72)	
Partially vaccinated	32 (23)	11 (27)	21 (21)	
No vaccines	26 (19)	23 (56)	3 (3)	
Don't Know Did Not Answer	7 (5)	3 (7)	4 (4)	
Aware of Senate Bill 277				0.06
Yes	79 (56)	29 (71)	50 (51)	
No	42 (30)	10 (24)	32 (32)	
Don't Know/Did not answer	19 (14)	2 (5)	17 (17)	
How did you learn about Senate Bill 277 (mark all that apply)				
Media	37 (26)	17 (41)	20 (20)	<0.01
Social Media	37 (26)	18 (44)	19 (19)	<0.01
School	17 (12)	6 (15)	11 (11)	0.77
Doctor	19 (14)	10 (24)	9 (9)	0.03
Health Department	7 (5)	2 (5)	5 (5)	1.00
Friends, neighbors, relatives	37 (26)	15 (37)	22 (22)	0.12
Other	7 (5)	2 (5)	5 (5)	1.00

The parental response rate (15%) and school-level response rate (7%) for this survey were low. Homeschooling populations have historically been a difficult population to identify study given that many states do not collect data on homeschools enrollment and there is a general distrust and refusal to participate in research [30]. Current literature on homeschooling and vaccines includes qualitative studies with small sample sizes [3,7] or convenience samples of parents from social media groups where a response rate could not be calculated [9]. Studies that reported response rates ranged from 18% among a convenience sample of homeschooling parents in Western Pennsylvania [6] to 71% among one southern California K-12 Charter school [31]. While our response rate was 15%, our study provided a broader sample of homeschooling parents through two homeschooling mechanisms in California. To our knowledge, this is the first to study vaccine attitudes, beliefs and decision-making in a diverse sample of homeschooling parents in California. Other limitations of this study include generalizability. It is likely our sampling frame did not capture ISP schools that offer a hybrid of classroom and non-classroom based instruction. We were also not able to include students who receive instruction through small PSAs, therefore our sample may not be generalizable to the full homeschooling population in California.

## 5. Conclusion

This study contributes to the limited literature on vaccine attitudes, beliefs, and decision-making among homeschooling parents. While previous studies have generally shown that homeschooling parents have concerns over vaccine safety and effectiveness, we

observed wide variation in vaccine attitudes and beliefs within the homeschooling population, with some parents having concerns over safety and effectiveness while others reported that their children would be up-to-date on vaccines even if there were no immunization mandates. As more states consider restricting access to personal belief exemptions and as the population of homeschooling families continues to increase, understanding if vaccination preferences play a role in decision-making to homeschool is important. We found that immunization mandates were a factor in the decision to homeschool for parents in this sample, confirming that vaccine-hesitant parents may turn to homeschooling as a way to avoid vaccination mandates. Future studies should explore the complexities around vaccine attitudes, behaviors, and decision-making among homeschooling populations and in response to changes in state-level vaccination policies.

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## Credit Author Statement

Dr Mohanty contributed to the conception and design of the study, completed the data acquisition, analyzed and interpreted the data, drafted the article, and critically reviewed and revised the manuscript; Ms Joyce contributed to the data acquisition, analyzed and interpreted the data and critically reviewed and revised the manuscript; Drs Delamater, Klein, Salmon, and Omer con-

tributed to the conception and design of the study and critically reviewed and revised the manuscript; Dr Buttenheim contributed to the conception and design of the study, analyzed and interpreted the data, and critically reviewed and revised the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

### Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. Mohanty, Ms. Joyce, Dr. Delamater, Dr. Omer and Dr. Buttenheim have indicated they have no financial relationships relevant to this article to disclose. Dr. Klein receives research support from the Centers for Disease Control, Merck, Glaxo-Smith Kline, Pfizer, Sanofi Pasteur, MedImmune, Protein Science (now Sanofi Pasteur) and Dynavax. Dr. Salmon has received consulting and/or research support from Merck, Pfizer, and Walgreens.

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