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## A potential new front in health communication to encourage vaccination: Health education teachers

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## ABSTRACT

**Objective:** To assess the potential for a new channel for effective vaccine health communication in the United States: the nation's health education teachers.

**Methods:** Content analysis of current curricular standards governing health education in the fifty states and the District of Columbia, and a 2019 nationally representative survey of middle and high school health education teachers in the United States.

**Results:** Only 12 states require any discussion of vaccines or immunization, and none provide detailed guidance to teachers on critical knowledge that might help young adults make wise immunization decisions. Only 42% of teachers discuss benefits of vaccination and immunization in their classes. In contrast to the teaching of evolution and climate change, only a small minority (2.4%) are classified as vaccine skeptics.

**Conclusions:** Public school health education classes are an under-utilized health communication channel with the unrealized potential to convey medically accurate information to millions of young Americans. Low levels of vaccine skepticism among teachers suggest that this channel can be effectively utilized to improve vaccination uptake and thereby improve collective health outcomes.

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### 1. Introduction

Prior to the spread of the novel coronavirus, vaccine uptake in the United States typically fell short of levels that achieve herd immunity. For example, only 91% of children 19–35 months had received the recommended dose of MMR vaccine and only 71% received recommended doses of the seven-vaccine series [1].

Today, public trust in vaccines is essential to the successful roll-out of the Covid-19 vaccination. Even if those most exposed or vulnerable to the virus are immunized, thus reducing mortality, outbreaks will continue to occur until 75% of people in each community receive the vaccine or generate strong natural immunity [2]. However, polling data show that as of June 2021, four in ten of unvaccinated adults are unwilling to get vaccinated and three in ten were uncertain – combined they constitute 23% of the countries adult population [3]. The same polling data showed that mothers of children under 18 report high levels of hesitancy for themselves, suggesting that efforts to vaccinate school-age children will face an uphill battle.

Past efforts to achieve high vaccination rates have taken three tracks. On the first, governments impose strict rules that raise the cost of non-compliance. For example, some states require vaccination for enrollment in public schools [4,5], leading some parents to vaccinate their children when they are turned away from school [6,7].

The second major track focuses on health communication. A very large body of scholarship has explored ways to effectively persuade and educate parents through channels such as discussions with family physicians [8–10], public service announcements [11], and community-based interventions [12]. A third track is via incentives, a trend that has gained high visibility in the Covid-19 pandemic, but less with respect to childhood vaccines.

In this paper, we call attention to an under-utilized channel of communication: health education classes in US public schools. We study the state of vaccine education in US public schools at two levels: education policy and teacher behavior. To the former, we begin our paper by examining *state content standards* – each state's written policy concerning what students are expected to learn in health education classes. We show that no states make vaccine literacy a high priority, and only a handful give vaccines even a small amount of attention. Then, we turn to teachers. We analyze the results an original, nationally representative survey

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of health education teachers to estimate the attention teachers are giving to vaccines in health classes today. Nearly three-fifths of teachers never discuss vaccines with their students, but those who do overwhelmingly emphasize the scientific consensus around vaccines, and no political, religious, or racial differences exist between these groups. Finally, our last section discusses the policy implications of these findings.

### 1.1. The potential of health education classes

Although much learning in school may be forgotten, health education teachers' potential impact is nevertheless enormous because of the size of their collective audience. In the 11th grade alone, 3.6 million students attend US public schools [13]. Of those, we estimate that roughly 435,000 are women who will bear one or more children by age 22 [14]. A comparable number of young men will become biological fathers as well. If current trends (9% non-compliance) hold, nearly 40,000 of those babies will not be vaccinated (see supplementary text A1 for details of this estimate). However, if a well-designed curricular intervention were even 25% effective in raising MMR uptake, it would halve the distance between the anticipated immunization rates and a herd immunity target of 95%.

Critically, health education is typically a required class, even if not mandated in every year of secondary schooling. In that light, the tens of thousands of middle and high school health education teachers have the opportunity to communicate the risks and benefits of early childhood vaccination to over 400,000 young women, and a comparable number of young men, who as parents will be facing vaccination decisions within the ensuing four years, and millions more who will impact broader public opinion and form families later in life.

The estimates provided above are based on just a single grade. However, most students will complete health education classes in multiple grades, spanning middle and high school. This creates potential for message repetition – an important opportunity because messages become perceived to be more truthful when they are repeated [15,16]. A coordinated curriculum – in which medically accurate information about the risks and benefits of vaccination were covered in each middle and high school grade – could substantially reduce vaccine hesitancy among each new cohort of parents.

With our current knowledge, it is impossible to forecast the precise effect of a comprehensive vaccine education initiative. But a variety of studies on other health education topics attest to the success that teaching interventions can have. Research has found positive results from modest interventions to increase students' factual knowledge HPV vaccination [17], and from school-based HPV vaccination uptake efforts, though the latter most often integrated education, outreach and vaccination provision [18]. Studies also show the long-term effectiveness of health education on a host of other healthy behaviors, from improving nutrition to reducing smoking and incidents of dating violence [19–21].

This paper explores how health education teachers, as an enormous channel for health communications, are *currently* being utilized to convey medically accurate information about vaccines. In doing so, we also pay mind to the feasibility of teaching interventions similar to the ones mentioned above—but on the topic of vaccines.

### 1.2. Theory: Teachers as street-level bureaucrats

From parents to principals to school boards, a variety of actors can seek to influence what gets covered in the classrooms of US public schools. But the two sources of influence that get most attention are the policies that set required learning goals for

schools in the state, and the discretion exercised by teachers when they have flexibility to choose class content.

State educational *content standards* are documents, created and approved by state departments of education, that provide a framework for instruction. They do so by detailing what students in each grade or school level are expected to learn. Teachers are the front-line employees expected to implement state policy. In general, research shows that detailed content standards can have a strong impact on the topics teachers include or exclude in their classes [22]. On the other hand, even in the presence of specific standards, teachers – as “street level bureaucrats” – enjoy a degree of autonomy that allow them to resist standards, add their own emphases, and teach topics in the ways they deem best. [23] The degree to which teachers resist state mandates varies by factors such as subject and seniority [24,25], but even when compliance is short of universal, almost all studies show a general pattern of teacher accountability to standards. Modification of standards can also have longer term impacts by shifting instruction in colleges of education so that future cohorts of teachers are more motivated and better prepared to implement the content priorities of the state than their more senior colleagues [26].

## 2. Methods

Our analysis studies each of these influences in turn. We begin with a comprehensive look at state-based health education content standards as they pertain to vaccines, and then turn to evidence from a nationally representative survey of health education teachers.

### 2.1. Classifying state content standards

For the first of our two analyses, we examined the health education content standards of all fifty states and the District of Columbia (for the purpose of this paper, treated as a “state”).

State health education content standards vary substantially in length, detail, and organization. The shortest is Alaska's single-page document which, at 433 words, leaves a great deal of discretion to teachers and local decision makers. In contrast, the combined middle and high school health content standards of the state of Mississippi run a total of 301 pages.

We systematically reviewed state standards by searching for the word stems “vac-” and “immun-” and reading relevant sections. When we found references that applied to the middle or high school level (or to all levels), we categorized each reference as either a “mention” of vaccinations or a “requirement” that they be discussed.

We generously coded discussion of vaccines as “required” when it was an explicit part of state learning standards; that is, students' understanding of the importance of vaccines is a stated learning goal. Requirements to discuss vaccines were normally placed in the context of disease prevention, but they also appeared in sections devoted to public health, sexual education, and personal responsibility. We coded discussion of vaccines as “mentioned” but not required when vaccination or immunization was suggested as an example relating to a separate goal or included in a set of recommended teaching resources, such as a glossary of terms students should know.

Requirements were coded to the level of schooling that they applied to. Only two standards required discussion of vaccines at both the high school and middle school levels, while ten required coverage at one level but not the other. When standards were applied to a grade level (K-12) as opposed to a level of schooling, we counted any standard for grades 6, 7, or 8 as pertaining to middle schools, and standards for grade 9, 10, 11, or 12 as pertaining to

**Table 1**  
Descriptive statistics for survey of teachers (N = 572).

	Mean or percent	Std Dev	Min	Max
Teacher social characteristics and values				
Identify as Female	50.5%		0	1
Identify as Black	8.1%		0	1
Identify as Hispanic	4.9%		0	1
Identify as Democrat	31.0%		0	1
Identify as Republican	27.6%		0	1
Say Bible is literal word of God	24.3%		0	1
Teacher training and education				
Masters of more	65.8%		0	1
Number of years teaching	17.6	10.1	1	42
Characteristics of their school				
Pct of students who are black	14.0%	20.0%	0.0%	99.0%
Pct of students who are Hispanic	14.0%	20.0%	0.0%	100.0%
Pct of students free lunch eligible	37.0%	27.0%	0.0%	100.0%

high schools. This is line with National Center for Education Statistics data which indicate that the three largest groups of public schools by grade span are those that cover grades K to 5 (elementary), 6 to 8 (middle), and 9 to 12 (high school) [27,28].

### 2.2. National survey of health education teachers

In addition to state policy, we also focus on the classroom behaviors of teachers, as they have considerable autonomy to go beyond their states’ minimum requirements. To assess whether this is the case with vaccines, we turn to a nationally representative survey of health education teachers. The survey was designed primarily to study sex education and STD and HIV prevention, but several questions about instruction on vaccines and infectious diseases were added as a module. We take advantage of those items for this report.

The 2019 Survey of Health Educations Teachers is based on a stratified probability sample of middle school and high school health education teachers in 49 states and the District of Columbia (no teachers from Delaware were included in the sampling frame). The study design called for each selected teacher to receive an invitation to participate by email. The email explained the purpose of the study and provided a link to the questionnaire hosted on the Qualtrics platform. Two additional reminder emails followed. As part of an experiment, 25% of the sample was randomly assigned to receive a pre-notification letter by post. These procedures resulted in a response rate (RR4) of 15.7% [29]. As detailed in online Appendix B, there was modest variation in response rate across teachers in different types of schools – most notably, lower response rates from teachers in majority-minority schools. To account for differential non-response, propensity-based calibration weights were calculated and employed to rebalance the sample [30,31] All results reported in this paper are based on weighted analysis and all measures of uncertainty account for weight-induced design effects. Table 1 provides basic statistics for the teachers who responded to the survey.

## 3. Results

### 3.1. States do not expect students to learn about vaccines

Our analysis of state health education content standards shows that very few states expect students to learn about vaccines and mentions of vaccines in these documents are almost always oblique or fleeting.

Table 2 lays out the number of states that require discussion of vaccines by level of schooling. Only two states (Colorado and Maryland) currently require health classes to discuss vaccination during

**Table 2**  
Number of states requiring discussion of vaccines, and number of mentions in health education standards.

Discussion of vaccines required in...	Number of states	Average number of mentions
Both middle and high school	2	2.0
Middle school only	5	2.0
High school only	5	2.4
Neither, but at least one mention	7	1.9
Neither and no mentions	32	0.0
Total	51	0.8

both the middle and high school grades. Five additional states (Arkansas, California, Kentucky, New Mexico, and Rhode Island) require coverage at the middle school level but not in high school. Five states are the inverse (Illinois, Mississippi, Pennsylvania, Texas, and Virginia), requiring discussion in high school but not in middle school.

State content standards can also mention vaccines and immunization without explicitly requiring their instruction. Among the 39 states that have no formal requirements, seven mention vaccines or immunization in some other context (Alabama, Georgia, Kansas, Missouri, New Hampshire, New Jersey, and Utah). The standards of the remaining 32 states, which account for roughly one-half of the nation’s public school enrollment, are completely silent.

Just as important as whether state standards require or mention vaccines, however, is the relative amount of attention they receive. If a state emphasizes vaccine education as central to its health curriculum, we expect teachers to respond by discussing vaccines more. If mentions are fleeting or cursory, we would expect standards to have little or no effect on teacher behavior.

Our analysis suggests the latter is the current case. Across all state standards, vaccines were only mentioned 40 unique times. Placed in context, many state standards stretch to nearly 100 pages—some more—so the relative attention placed on vaccination appears to be minimal.

A closer look at mentions and requirements confirms this. Even when discussion of vaccines is required, no states highlight vaccine literacy as a learning goal unto itself. As an example, Arkansas’s health education standards referenced vaccines more than the standards of any other state, doing so twice for its middle school standards and four times for high school. Yet, its most explicit reference was as part of a disease prevention learning goal, requiring that students learn,

*“Research practices of early detection and disease prevention: health screenings, proper diet, regular physical activity, self-exams, and vaccinations.”*

This is an extraordinarily weak cue to teachers.

To compare inattention to vaccines to another health education topic that attracts public attention and occasional controversy, 34 states currently require coverage of HIV and sexually transmitted infections. Of these, many are comprehensive in nature and provide specific instructions to teachers – for example, in specifying whether condoms must be discussed as a means of reducing infection risks [32]. We found no comparable specificity regarding vaccines in any state’s standards.

### 3.2. Explaining variation in state content standards

Even though mentions of vaccines and immunizations are sparse across the 51 state content standards, they may still be informative as to the feasibility of teaching interventions on the topic. If variation in these mentions can be explained by public attitudes, for instance, this may be evidence that classroom efforts to encourage vaccination will meet resistance in some places. However, if variation can be explained by a state’s administrative capacity, it may suggest that vaccines have simply yet to garner enough attention from policymakers.

We expect that differences in the mentions of vaccines is primarily a matter of policymaking capacity. While the history of vaccine hesitancy dates to the 1850s, the late 20th century in the US saw widespread acceptance of immunization, and public confidence in vaccines has only recently begun to falter [33]. It takes policymakers time to “catch up” with new trends, and states with greater policymaking capacity are likely to do so first. Indeed, research into state health policy suggests that, by a significant margin, legislative professionalism is the strongest determinant of attention to vaccines in state legislatures [34]. The greater a state’s policymaking capacity, the more likely the policy agenda will “get around” to vaccines as one of the many issues it can address. The same study also ascribes smaller effects to state partisanship (more support for Democrats indicates greater public demand for health policy) and vaccine uptake (higher uptake indicates a more pro-vaccine public) [34].

We anticipate that similar trends will hold when it comes to the inclusion of vaccines in state health education content standards. In Table 3, a series of t-tests compares states that require discussion of vaccines (at either level of secondary schooling) to those that do not. We measure state partisanship with the Republican percentage of the vote in the 2016 presidential election; vaccine uptake with 2017 estimates from the CDC on the percentage of 19 to 35-month-old children who received the MMR vaccine; and policymaking capacity with state legislative professionalism scores, which reflect factors such as legislative salaries, length of sessions, and policy output [35]. (Note that scores are missing for four states—Louisiana, Mississippi, New Jersey, and Virginia—and the District of Columbia.)

On all three comparisons, the differences between states that require discussion of vaccines and those that do not are in the expected direction, but only one is statistically significant. Where policymaking capacity is greater, it is more likely that health edu-

cation standards will include vaccines, and the difference between groups is sizable, being roughly the same as a shift from the 9th most professional legislature (Wisconsin, 0.75) to the 23rd (Iowa, -0.16).

Having reviewed every state’s health education content standards, we can conclude that *few state boards of education see vaccine knowledge to be relevant to the scope and goals of middle and high school health education*. Among the minority of state standards mentioning vaccines, none provide specific guidance to teachers. The variation that does exist is neither driven by partisanship nor public health need, but by the more mundane variable of policy-making capacity. This suggests that there are opportunities for states to modify their curricula, especially if efforts work through educational agencies and legislative committees rather than through broader political strategies.

Now, we turn our attention to a second analysis on the teachers themselves, whether and how they talk about vaccines in class, and their responsiveness to state standards.

### 3.3. The time teachers devote to vaccine literacy and the content of instruction

While state educational content standards set the minimum learning goals for the public education system, teachers are “street-level bureaucrats” who have the autonomy to go beyond those requirements [23]. In our survey, four questions asked teachers to report on their teaching practices with respect to common vaccinations. The introduction and first question were:

*Below are some additional viewpoints that some teachers emphasize, and others may ignore or disagree with. For each one, please select the answer that comes closest to your approach in this class.*

*On balance, the benefits of childhood vaccines for measles, mumps, and rubella (MMR) outweigh the risks.*

- o I emphasize this viewpoint a great deal.*
- o I emphasize this viewpoint somewhat.*
- o I challenge this viewpoint somewhat.*
- o I challenge this viewpoint a great deal.*
- o I do not discuss this one way or the other.*

In fact, most teachers (58%) never discuss the benefits and risks of the MMR vaccine (Fig. 1). Of those who discussed it, emphasizers outnumbered challengers by sixteen to one. This pattern is not unique to MMR. As illustrated in the second panel of Appendix Figure A1, an otherwise identical question about the human papillomavirus vaccine produced a similar pattern, though with more teachers reporting that they challenge the conventional epidemiological understanding.

We also asked teachers whether they emphasized the idea that:

*Families that do not vaccinate their children can place other children at risk by weakening herd immunity*

Far fewer teachers, only 37%, report discussing this in their classes and, of those, about one in seventeen said they challenged this idea in class. Finally, we addressed vaccine skepticism by asking if they emphasized or challenged this idea in class:

*More time is needed to be able to fully investigate the effects of the MMR vaccine on young children*

**Table 3**  
States with greater policymaking capacity more likely to require vaccine education.

	States that require vaccine education	States that do not require discussion of vaccines	t-stat	p-value (one-tailed)
GOP vote share (2016)	46.0%	49.1%	0.77	0.22
MMR uptake (2017)	92.1%	91.4%	0.83	0.20
Policymaking capacity	0.75	-0.17	-1.77	0.04

### Teacher Messages about Vaccines

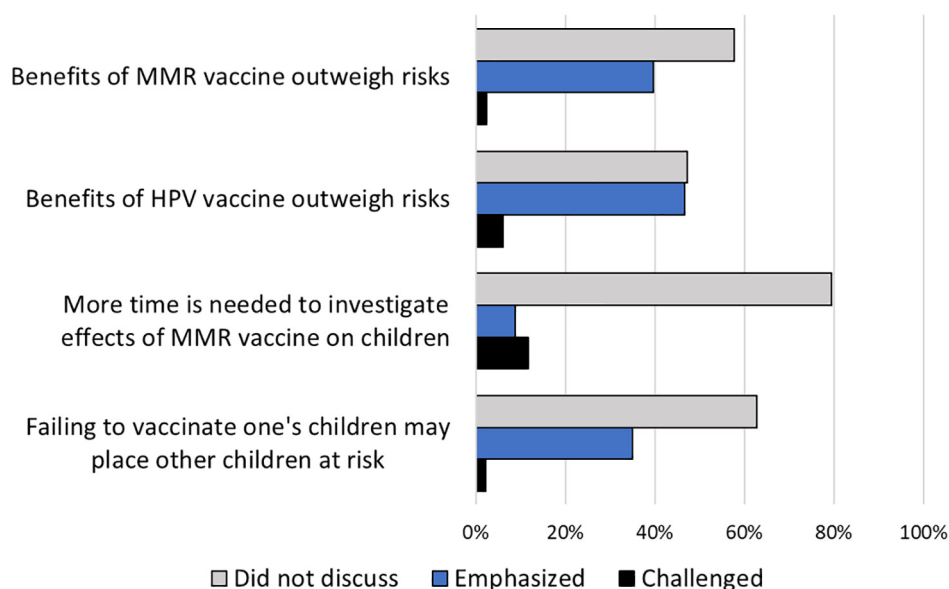


Fig. 1. Teacher messages in the classroom.

Here, we see that a substantial number of teachers – 8% - explicitly emphasize this idea to their students. Only 13% explicitly reject this idea and most do not mention the empirical basis of health recommendations at all. Among those who discussed this, nearly 40% communicated to their students that the jury is still out on the effects of the MMR vaccine on children.

#### 3.4. The messages teachers convey about vaccines: A typology

We can combine the answers to these questions to create a summary typology of US middle and high school health teachers (Fig. 2). Based on their self-reports of classroom behavior we can say that the majority, 57.8% never discuss the MMR vaccine at all. The second largest group, 32.2% of teachers, are unambiguous advocates of the MMR vaccine. They emphasize that its benefits outweigh the risks, and either give no indication or explicitly challenge the idea that the science behind these vaccines is tentative.

A notable minority, 7.6% of teachers, send mixed messages. While they tell students that the benefits of the MMR vaccine outweigh its risks, they also say that more time is needed to fully investigate the vaccine's effects.

#### Teacher approach to MMR Vaccine education

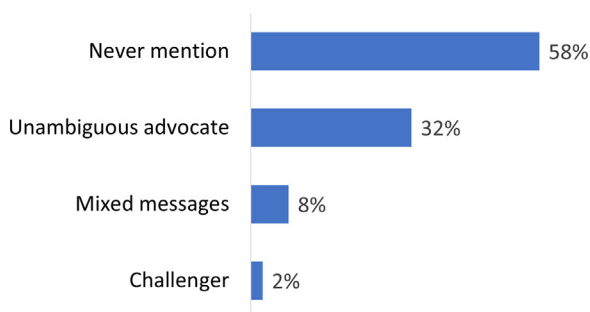


Fig. 2. Teacher messages in the classroom, summarized as a typology of teaching approaches.

Finally, only 2.4% of teachers are “vaccine challengers.” These teachers challenge the viewpoint that the MMR vaccine’s benefits outweigh its risks. Though only 2.4% of all teachers, “challengers” represent 5.7% of teachers who discuss the MMR vaccine in class.

#### 3.5. Is variation in teacher message a function of political orientation?

Teachers are clearly an under-utilized resource in the health communication battles to increase vaccine uptake. As our earlier analysis showed, less than a quarter of states require that vaccines be discussed in the classroom, and when such mandates are included in state content standards, the mention is almost always peripheral or brief. Amending standards to emphasize immunization can send a signal to teachers and other content providers (such as textbook publishers) about the importance of the topic.

However, policymakers may worry that emphasizing vaccines may lead to resistance among teachers. Previous research on other controversial science topics, such as climate change and human evolution, shows strong evidence of partisan and ideological polarization. Indeed, teacher’s personal views on politics and religion are the most powerful predictors of whether or not they clearly convey the scientific consensus to students [25,36–38].

To see if vaccine education might be susceptible to the same kinds of divisiveness, we examined whether a teacher’s advocacy for the MMR vaccine is associated with a range of social, economic, and political variables.

To do so, we compared “unambiguous advocates” for MMR vaccination to all other teachers in the sample. The results, reported in Table 4, show surprisingly few differences. In terms of personal characteristics and values, advocates and other teachers do not differ by partisanship, beliefs in the Bible, race, or gender.

Moreover, we see no differences in terms of teacher educational background. Equal percentages of vaccine advocates and others have earned a master’s degree or higher, and the mean respondent in each group reports 16 to 18 years of teaching experience.

Looking at contextual factors, we see that the teachers in states whose standards seemingly require students to learn about vaccinations were marginally more likely to advocate for vaccines than

**Table 4**  
Comparisons of vaccine advocates to all other teachers.

	Mean or percent for advocates	Mean for all others	t-value	p-value
Teacher social characteristics and values				
Pct female	54.9%	49.1%	1.14	0.26
Pct Black	5.7%	9.4%	−1.29	0.20
Pct Hispanic	5.0%	3.7%	0.63	0.53
Pct Democrats	33.8%	29.7%	0.82	0.41
Pct Republicans	31.9%	25.7%	1.29	0.20
Pct Bible is word of God	20.7%	26.1%	−1.18	0.24
Teacher training and education				
Masters of more	61.8%	67.4%	−1.17	0.24
Number of years teaching	16.7	18.1	−1.30	0.19
Characteristics of their school				
Pct of students who are black	9.4%	16.1%	−3.26	0.00
Pct of students who are Hispanic	23.5%	21.5%	0.81	0.42
Pct of students free lunch eligible	35.2%	37.8%	−0.95	0.34
State standards “require” vaccine instruction				
Pct in requiring states	25.9%	22.1%	0.90	0.37

teachers in other states, but this difference (bottom row of Table 4) is not significant. This null finding speaks less to issues of teacher accountability than to the lack of direction and specificity provided by the few states that mention vaccines in their standards. Advocates and others teach at schools with roughly the same percentages of students with Hispanic heritage, and of students who receive free lunch. However, advocates are significantly less likely to work at schools with higher percentages of African American students. This means that Black secondary school pupils are less likely than their white counterparts to be exposed to scientifically correct information about vaccine efficacy and safety.

These results point toward two conclusions. First, they suggest a non-trivial racial disparity: Black students receive systemically less information about vaccines than their peers. Second, they show a lack of significant political, social, or professional cleavages that might serve to complicate the development of new policies or hinder their implementation.

### 3.6. Teachers report that standards impact their teaching choices

Finally, policymakers considering a mandate to add vaccine education into state standards may wish to know more about teacher compliance with these standards. Although the balance of the research suggests that teachers are responsive to policy [22], our survey included sought to gauge the responsiveness of health teachers specifically.

Fig. 3 presents the responses of teachers to a question that asked how much influence state curricular standards have on their class content in general. Almost all teachers report that state standards have at least “some influence” over what they cover in the classroom. More strikingly, about seven in ten report that state

standards are a “major influence” or one that “completely determine[s] class content.”

## 4. Discussion

Our two analyses point to a lack of attention to vaccine literacy in secondary health education in the United States. Vaccines are completely ignored by most states and only briefly mentioned in the content standards of others. The mentions are so brief and so general, that they provide little in the way of guidance to classroom teachers. Indeed, instruction in states that mention vaccines in their standards is statistically indistinguishable from instruction in states whose standards are silent.

However, teachers tell us that these standards play a major role in which topics are covered in their classes. This suggests that if all fifty states and the District of Columbia set out clear vaccine literacy standards for their secondary health students, teachers would be accountable to those changes.

While our results show that a small number of teachers convey messages that echo the concerns of vaccine skeptics, the topic is not nearly as politically or religiously polarized as evolution or climate change education. If provided curricular materials that are medically accurate, grade appropriate, and consistent with new state standards, health teachers in the US’s 30,000-plus secondary schools could play a major role in augmenting other efforts to encourage vaccine literacy and uptake.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

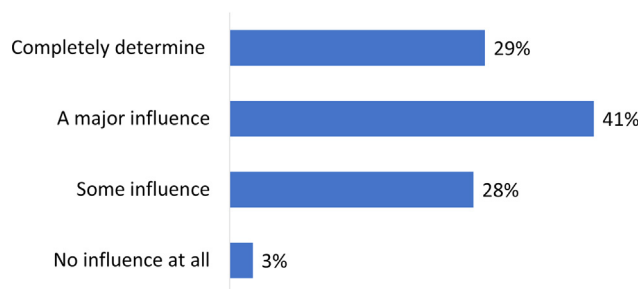
## 6. Human subjects

The study protocol and data management plan were reviewed by the Penn State IRB and classified as “Exempt” (Study # 00011933).

## 7. Data statement

All data and scripts used to produce tables and figures will be available at <https://doi.org/10.7910/DVN/T262TM> [38] within six months after publication.

**How much do state standards influence class content?**



**Fig. 3.** Influence of state policies / curricular standards on class content and learning objectives.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary material

Supplementary material to this article can be found online at <https://doi.org/10.1016/j.vaccine.2021.06.050>.

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