

# Personal Belief Exemptions From School Vaccination Requirements

Douglas S. Diekema

Department of Pediatrics, University of Washington School of Medicine; Department of Health Services, University of Washington School of Public Health; and Treuman Katz Center for Pediatric Bioethics, Seattle Children's Research Institute, Seattle, Washington 98101; email: diek@u.washington.edu

Annu. Rev. Public Health 2014. 35:275–92

First published online as a Review in Advance on December 11, 2013

The *Annual Review of Public Health* is online at [publhealth.annualreviews.org](http://publhealth.annualreviews.org)

This article's doi:  
10.1146/annurev-publhealth-032013-182452

Copyright © 2014 by Annual Reviews.  
All rights reserved

## Keywords

immunization, vaccine mandates, religious exemptions, medical exemptions, philosophical exemptions

## Abstract

Despite the impact vaccination has had on the control and prevention of many infectious diseases, some parents choose not to vaccinate their children. Although there is no federal law requiring vaccination of children in the United States, all states require evidence of vaccination against at least some diseases as a condition of school entry. Which vaccines are required; how many doses are required; whether entry requirements apply to child care, kindergarten, or middle school; and whether exemptions from vaccine requirements will be allowed all differ by state. All but two states allow some kind of personal belief exemption from school vaccination requirements. This article reviews the history of school vaccination requirements and exemptions, the legal status of state vaccination laws and exemptions, the impact of school vaccination requirements and personal belief exemptions on vaccination rates and disease incidence, and strategies for maintaining adequate vaccination rates in states that allow personal belief exemptions.

## INTRODUCTION

Vaccines have been an important tool in the control and prevention of infectious diseases for over 200 years. Edward Jenner developed the first widely used vaccine against smallpox in 1796 after noting that milkmaids who had been infected with cowpox rarely became infected with smallpox during smallpox epidemics. Vaccination against smallpox was rapidly adopted in Europe and was first performed in the United States in 1800. It would be more than 100 years before a second vaccine, against diphtheria, came into widespread use and 150 years before the polio vaccine was introduced. Vaccine development has accelerated substantially in more recent years, offering protection against many infectious diseases.

Vaccines function in two different ways. First, they protect most vaccinated individuals directly against disease by inducing immunity. Second, they protect individuals from person-to-person disease transmission through a phenomenon known as herd immunity. Herd immunity develops when a sufficient proportion of individuals in a community achieve immunity to the extent that disease introduced into the community would be unable or unlikely to spread because of the small probability that an infected individual would encounter a susceptible individual. This community protection benefits those who cannot be vaccinated for medical reasons, those who are too young to be vaccinated, those who choose not to get vaccinated, and those who received vaccinations but either did not mount an adequate immune response or whose immunity has waned over time.

The importance of herd immunity to susceptible individuals is illustrated regularly during outbreaks of vaccine-preventable disease. In 2008, an outbreak of *Haemophilus influenzae* type b in Minnesota resulted in infection of five young children. Three of the children had not been vaccinated because of their parents' opposition to vaccination, one was too young to have completed the vaccination series, and the other, a 15-month-old who suffered permanent neurologic injury from meningitis, had been vaccinated but was found to have an immune disorder that impaired the response to vaccination (9). In addition to the health consequences to the individuals infected during disease outbreaks, the economic consequences can also be considerable (15).

The current vaccine schedule calls for 10 vaccines representing 14 diseases to be given during the first 6 years of life: hepatitis B (3 doses), rotavirus (2–3 doses), DTaP (5 doses), Hib (3–4 doses), pneumococcal conjugate vaccine (4 doses), inactivated polio virus (4 doses), influenza (yearly), measles-mumps-rubella (2 doses), varicella (2 doses), and hepatitis A (2 doses). Between 6 and

## DEFINITION OF TERMS

Herd immunity exists when a sufficiently large proportion of a population develops immunity to an infectious disease, either through vaccination or prior infection, that disease introduced into the community would be unable or unlikely to spread from person to person because of the small probability that a susceptible individual would encounter an infected individual. Herd immunity is a primary mechanism by which individuals who remain susceptible are protected against infectious diseases that are spread from person to person. Herd immunity is compromised when individuals within a population refuse vaccination. The proportion of immune individuals in a population required to achieve herd immunity varies depending on a number of factors including the infectiousness of the disease, the effectiveness of the vaccine, and the degree of contact between individuals within that population. Whereas an immunization rate of 80% within a population may be sufficient to establish herd immunity against rubella and mumps, pertussis and measles require a population immunization rate of closer to 95%. Within the setting of a school, where children are in frequent and close contact for extended periods of time, the rate of immunization required to prevent spread of disease to susceptible individuals may be even higher.

18 years of age, the vaccine schedule recommends the addition of human papillomavirus (3 doses), meningococcal conjugate vaccine (2 doses), a Tdap booster, and annual influenza vaccinations.

There is no federal law requiring vaccination in the United States. All states now require evidence of vaccination against at least some diseases as a condition of school entry. Which vaccines are required, how many doses are required, whether a documented history of disease is acceptable in lieu of vaccination, and whether entry requirements apply only to kindergarten or to other grade levels as well (child care, middle school, high school, college) all differ among states. Some states allow local school boards to set requirements for some vaccines. State laws also vary on what kinds of exemptions from vaccine requirements will be allowed. As of December 2012, all states allowed exemption from school vaccine requirements for medical reasons, and 48 states and the District of Columbia offered either religious exemptions or a broader philosophical or personal belief exemption from school vaccination requirements. Considerable variation also exists among states with regard to enforcement of school vaccination requirements and the process for obtaining an exemption. In contrast, only three provinces in Canada require vaccination for school entry, and all three provinces allow personal belief exemptions (62).

This article reviews the history of school vaccine requirements and exemptions from those requirements, the legal status of state vaccine laws and exemptions, the impact of school vaccine requirements and personal belief exemptions on vaccination rates and disease incidence, and strategies for maintaining adequate vaccination rates in states that allow personal belief exemptions from school vaccination requirements.

---

**Religious exemption:** state law provision permitting parents to exempt their children from the school vaccine requirement if it contradicts their religious beliefs

---

## HISTORY OF SCHOOL VACCINATION REQUIREMENTS

Until vaccination was introduced by Edward Jenner in 1796, smallpox epidemics represented a major threat to human life, causing death in as many as half of those infected by its most virulent form. The introduction of smallpox vaccination markedly reduced outbreaks in Europe and the United States by the early 1800s. European governments were more open to compulsory vaccination than was the United States, with laws requiring smallpox vaccination of infants appearing in Bavaria in 1807, Denmark in 1810, Norway in 1811, Bohemia and Russia in 1812, and Sweden in 1816. Sweden's law made specific reference to vaccination as a requirement for entry into any school or college (28). England made vaccination against smallpox mandatory for all children in 1853 (1).

By the early 1800s in the United States, voluntary vaccination of individuals against smallpox had made epidemics sufficiently rare that vaccination rates dropped. This decrease, in turn, led to a rising incidence of the disease by the 1830s. This resurgence of smallpox occurred at a time when the number of public schools was increasing and states and communities were beginning to make school attendance a requirement for all children (21). The gathering of children in schoolhouses, a situation that aided the spread of smallpox, made linking school attendance with vaccination a logical step. In 1827, the city of Boston became the first municipality in the United States to establish a vaccine mandate for school entry, ordering teachers to require all children attending

### DEFINITION OF TERMS

A personal belief or philosophical exemption is a provision in the state law, which allows parents to exempt their children from the school vaccine requirement if it contradicts parental beliefs beyond those considered religious or spiritual beliefs. These exemptions can include moral, philosophical, or personal beliefs that relate to vaccines.

school to provide evidence of vaccination. Massachusetts became the first state in the United States to make smallpox vaccination mandatory in 1855, with a law requiring vaccination of all public schoolchildren. New York passed a state law in 1860 empowering local school boards to refuse school admission to unvaccinated children (21). Other New England States passed similar laws over the next 20 years. States in the Midwest, South, and western United States followed suit, requiring vaccination for school attendance beginning in the 1880s. Whereas some states mandated vaccination of all children for school attendance, others passed laws that authorized local jurisdictions to enact school vaccine regulations under certain conditions (for example, during an epidemic). Because enforcement of these laws was often the responsibility of local school boards and some school boards opposed vaccination, the application of these laws was patchy, and periodic outbreaks continued (21). By the turn of the twentieth century, most states had laws that either required vaccination of children attending public schools or allowed local jurisdictions to require it (65).

These early laws related specifically to smallpox. As other vaccines were developed, state and local laws were amended to include newer vaccines. Diphtheria vaccination was added in some states by the late 1930s, followed by polio and measles in the 1960s (32). By 1970, laws in 26 states required vaccination prior to school entry (32). Another two states allowed local jurisdictions to require vaccination for school entry, and 22 states had no requirements. The District of Columbia required only the smallpox vaccine for school entry. By this time, most state laws requiring vaccination applied to entry into public and private schools.

During the 1970s, outbreaks of measles, which involved primarily school-age children, provided a major incentive for states to enact or expand school vaccination laws, particularly because schools represented a major site of disease spread (34, 46, 47). By 1980 all 50 states had some kind of law requiring vaccination as a condition for school attendance. The intent of these laws encompassed both the narrow goal of eliminating outbreaks within the schools and the broader public health goal of protecting the community against disease spread.

## **OPPOSITION TO SCHOOL VACCINE REQUIREMENTS AND THE RISE OF EXEMPTIONS**

In general, considerable resistance has always accompanied compulsory vaccination laws. In the late 1800s through the early 1900s, some parents responded to school vaccination laws by refusing to send their children to school, sending their children to private schools, wiping the vaccine from their children's arms following vaccination, attempting to fake vaccine scars, and refusing to comply with vaccination requirements (65). This resistance was driven in part by the risks of the smallpox vaccine and the risks of inoculation, which included the transmission of other diseases, including tetanus. Parents also protested on the grounds that vaccination threatened the safety of their children, usurped their parental authority, and violated the bodily integrity of their children. Others opposed the laws on religious grounds. Christian Scientists, whose founder, Mary Baker Eddy opposed these laws, nonetheless advised followers to comply with them. Opposition to vaccination became stronger during the early 1900s when a milder form of smallpox, *variola minor*, became the dominant strain. This strain rarely caused death, leading many to conclude that the vaccine was more dangerous than the disease it prevented (12).

Opponents of vaccination continually sought to amend or repeal school vaccination laws (21). The Massachusetts school vaccination requirement was amended by the legislature in 1894 to allow an exception for any child who could produce a certificate stating that they were "unfit for vaccination" and signed by a physician. An anti-vaccination pamphlet titled "Vaccination Is the Curse of Childhood" circulated in Boston during the early 1900s, encouraging parents to find

a physician who would provide such certificates for their children (61). Elsewhere, the British government, under pressure from anti-vaccinationists, introduced a conscience clause in 1898 allowing those who obtained a certificate of exemption to choose not to vaccinate their children (59).

Early legal challenges to school vaccine laws supported the state's constitutional authority to make school entry contingent upon vaccination status. Such laws survived challenges in the Supreme Courts of both New York and Illinois in 1895, although the Illinois Supreme Court held that the board of health could enforce its school vaccination mandate only when smallpox was present or threatening a community (21). Other state supreme courts upheld school vaccination laws, including California in 1890 and Pennsylvania in 1894 (21). Challenges to laws mandating vaccination eventually reached the US Supreme Court. In 1905, in *Jacobson v. Massachusetts*, the Supreme Court upheld a Massachusetts law requiring vaccination of all residents, ruling that "the police power of a state must be held to embrace, at least, such reasonable regulations established directly by legislative enactment as will protect the public health and the public safety" (31, p. 25). In 1922, in *Zucht v. King*, the Supreme Court specifically upheld a local ordinance requiring vaccination as a requirement for school attendance (68).

With the US Supreme Court clearly empowering states and local jurisdictions to mandate vaccination as a condition of school entry, opponents focused renewed efforts on lobbying state legislatures to eliminate or alter school vaccination requirements. Some of these efforts were successful, including repeals of school vaccination laws in the state of Washington in 1919 and Wisconsin in 1920. Legislatures in Utah and North Dakota enacted laws forbidding compulsory vaccination (12). Anti-vaccination sentiment decreased somewhat by the 1930s, and efforts to eliminate vaccination laws became rare during the 50 years that followed, particularly if legislatures provided a means whereby objectors could obtain an exemption from school vaccination requirements (12). By 1970, most states allowed exemption from school vaccine requirements if a physician attested that it would be dangerous to the child's health, or if the parents could demonstrate that the vaccination would violate the teachings of a recognized religious organization to which they belonged, and five states allowed exemption from the law if a parent simply objected in writing (32). As more state legislatures enacted laws requiring vaccination as a condition of school entry in the 1960s and 1970s, most included exemptions for children whose parents had religious objections to vaccination. These exemptions were added at least in part owing to the lobbying efforts of the Christian Science Church (13). Whether these exemptions were restrictive (allowing only exemption for recognized or established religions) or liberal (allowing exemption for personal beliefs) varied by state.

Controversies over school vaccination laws once again returned to the United States in the 1980s when the very public debate over the safety of the pertussis vaccine led to increased concern about the safety of childhood vaccination (12). Since the 1980s, anti-vaccine advocates have argued for the elimination of school vaccination requirements and the expansion of exemption opportunities. Many of the arguments heard today opposing vaccination requirements echo those of the previous 200 years. These individuals and groups oppose school vaccination requirements for three basic reasons. First, they argue that vaccines are unsafe and/or ineffective, causing harm to those who receive them. These claims of harm include the belief that vaccines can cause serious adverse effects (such as autism), that vaccines can negatively impact the immune system, and that the effects of injecting foreign biological material into humans is unknown. Most of these claims lack a basis in scientific data. Second, they argue that vaccination is unnecessary, either because the diseases they are intended to prevent are rare or because they are not serious. Finally, they argue that school vaccination requirements represent an unjust intrusion of the government into private affairs (including interference with the religious or philosophical beliefs of families), violate civil

## DEFINITION OF TERMS

The terms immunization and vaccination are frequently used interchangeably, although they refer to slightly different processes. Narrowly defined, vaccination refers to the injection of a killed or weakened infectious organism, a component of the organism, or the biological product of an organism to prevent a disease. Immunization refers to the process by which a person or animal becomes protected against a disease. Immunization can occur either through vaccination or through previous infection with the organism.

liberties, and represent government oppression; and that education and voluntary compliance are sufficient to accomplish any goals of vaccination. These claims are frequently accompanied by an underlying distrust of government, scientists, and vaccine manufacturers.

The design of school vaccine mandates must inevitably grapple with the balance between individual freedom and community welfare (20). Balancing individual freedom with protecting the population's health represents one of the most important ethical issues surrounding the implementation of many public health measures, including vaccination. Restrictions on individual liberty are justified when individual decisions or actions put others at risk of serious harm (23, 37, 51). Even if one argues that parents should be free to refuse vaccination on behalf of their children, it does not follow that this right weighs more heavily than the right of others to be free from unnecessary exposure to vaccine-preventable infection. The state's duty to protect children attending public schools further justifies laws that require immunization before school entry. Parents who choose not to vaccinate their children increase the potential for harm to other children at school, including those who cannot be immunized because of medical conditions and vaccinated children who remain susceptible to disease (17, 18, 27, 42). This potential for harm increases significantly if enough parents choose to forgo vaccination for their children that herd immunity in the school and community is undermined.

Although school vaccination requirements interfere with individual freedom to some degree, they fall short of true state compulsion because states require vaccination only as a condition of school attendance. In most states, parents have the choice of vaccinating their child, seeking an exemption to the requirements, or homeschooling their children (or in some states, sending their children to private schools). Thus, school vaccination requirements as they currently exist are less intrusive on individual liberty than a broader requirement for immunization of all citizens would be (18).

Personal belief exemptions may serve an important role in preserving school vaccination requirements in all 50 states. Laws that do not allow some degree of conscientious objection can further inflame anti-vaccination groups, leading to increased resistance to these laws. Some historical evidence has shown that communities seeking to vaccinate individuals through coercive methods (without an exemption option) rather than through education and other techniques that allow for free choice have met with increased resistance that has ultimately thwarted their efforts (35). The existence of personal belief exemptions decreases formal opposition to school vaccination laws by allowing parents who object to vaccination to act on that belief while still allowing their child to attend school.

## LEGAL CHALLENGES TO PERSONAL BELIEF EXEMPTIONS

US Supreme Court decisions, including *Jacobson v. Massachusetts* and *Zucht v. King*, have made it clear that states possess the authority to require vaccination as a condition for school entry. It is



also clear that states are not obligated to offer religious exemptions under the Constitution. In 1944, the US Supreme Court's decision in *Prince v. Commonwealth of Massachusetts* (49) established that religious freedom does not extend to those actions that endanger others, including either the public health or the health of one's children: "The right to practice religion freely does not include the liberty to expose the community or the child to communicable disease or the latter to ill health or death."

Similarly, a number of court rulings (36, 67) have clarified that the right to religious freedom is not infringed by requiring schoolchildren to be vaccinated and that citizens are not granted a First Amendment right to religious exemption from laws requiring vaccination for school attendance. According to the US District Court in the Western District of Arkansas in *McCarthy v. Boozman* (36), "The constitutional right to freely practice one's religion does not provide an exemption for parents seeking to avoid compulsory immunization for their school-aged children."

Challenges to state laws continue, but generally fail. Most recently, in *Workman v. Mingo County Schools*, Jennifer Workman challenged West Virginia's school vaccination requirement (66). West Virginia is one of only two states with no religious exemption to the law. Ms. Workman sought to have her child exempted from the vaccination requirement, a request that was denied. She filed suit arguing that the refusal to grant an exemption violated her First Amendment right to practice her religion and violated her Fourteenth Amendment right to due process and equal protection on the grounds that she was not allowed to simultaneously enroll her children in school and follow her religious beliefs, even though parents with different or no religious beliefs could conceivably do so. The District Court dismissed her claims (66), concluding that "West Virginia is not obligated to provide such an exemption; its mandatory immunization program is consistent with the United States constitution." In 2011, the US Fourth Circuit Court of Appeals affirmed this decision, and the Supreme Court declined to hear the case.

Although they are not obligated to do so under current federal or constitutional law, 48 states and the District of Columbia offer religious or personal belief exemptions from school vaccine requirements. Religious exemptions can take different forms from state to state. State laws may limit exemptions to individuals who belong to an "organized," "recognized," or "established" religion, some states require that the beliefs be "genuinely and sincerely held," and others simply require that parents attest that they oppose vaccination for religious reasons (39).

Some evidence suggests that religious exemptions, as opposed to broader personal belief exemptions, may run afoul of the First Amendment's establishment clause when they provide preferential treatment to particular religious doctrines—those exemptions requiring that parents belong to a recognized religious organization, for example (28, 36, 55). In 1979, the Mississippi Supreme Court in *Brown v. Stone* held that although the state's interest in the public health and its duty to protect children from harm were sufficient to override the religious rights of parents seeking to exempt their children from vaccination prior to school entry, the state's religious exemption was unconstitutional because it violated the equal protection rights of those who did not qualify for exemption for religious reasons (4). In response, Mississippi simply dropped their exemption and is currently one of only two states (along with West Virginia) to offer only a medical exemption from vaccination requirements for school entry. In 2001, a US District Court in Arkansas held that the state's religious exemption, because it limited itself to parishioners of a "recognized church or religious denomination," was unconstitutional under the free exercise and establishment clauses of the First Amendment and the due process clause of the Fourteenth Amendment (36). Two years later, Arkansas legislators rewrote the law to allow parents to seek an exemption from school vaccine requirements for philosophical (personal belief) objections. Other states have taken similar actions, expanding restrictive religious exemptions to personal belief exemptions to avoid running afoul of the Constitution's First and Fourteenth Amendments. Religious exemptions that require

---

**Medical exemption:** state law provision permitting an exemption from school-entry requirements for vaccines to which a child has a medical contraindication

---

only a “sincerely” held religious belief are more likely to prevail against a constitutional challenge, although they may still be found to discriminate against those with “sincerely” held nonreligious beliefs about vaccination.

Personal belief exemptions are allowed in 19 states. Philosophical or personal belief exemptions are easier to obtain than religious exemptions because they require only that the parent of a child hold a personal belief that opposes vaccination. Because these exemptions do not rely on religious belief, they do not pose constitutional issues under the First Amendment’s establishment clause, but they may still raise equal protection issues under the Fourteenth Amendment (39).

## **FACTORS ASSOCIATED WITH REFUSAL OF CHILDHOOD VACCINES**

There are many factors associated with a parent’s decision to refuse vaccine administration to their child and to seek exemption from school vaccine requirements. These include concerns about whether vaccines are safe, efficacious, and necessary. These concerns may be coupled with distrust in the government, organized medicine, and the pharmaceutical industry.

Freed and colleagues (24) found that although 90% of parents felt that vaccination was a good way to protect their child from disease, 54% were concerned about serious adverse effects from vaccines, 31% felt that parents should have a right to refuse vaccines required for school entry for any reason, and 11.5% had refused at least 1 recommended vaccine. They identified HPV, varicella, and meningococcal conjugate vaccines as the most common vaccines refused by parents.

Another survey of parents of school-aged children revealed that 75% of children with nonmedical exemptions to the school vaccine requirements received at least some vaccines (54). Varicella was the most common vaccine not accepted by parents who sought a nonmedical exemption, followed by hepatitis B, pertussis, and tetanus. The most common reason given by parents who sought an exemption from school vaccine requirements was the concern that vaccines cause harm. Parents of exempt children were more likely than parents of fully vaccinated children to report concerns about vaccine safety and efficacy, a low level of trust in the government, and a perception that the risks of contracting vaccine-preventable disease and the severity of vaccine-preventable disease were both low. Parents of exempt children were also more likely to report confidence in alternative medicine professionals and less likely to report confidence in medical, public health, or government sources of information (54). Parents opposed to school vaccination requirements are more likely than parents who support them to believe that vaccines may not be safe, that the body can protect itself without vaccines, that vaccines are not important to a child’s health, that vaccines are not necessary to prevent certain diseases, that vaccines are given to prevent diseases that are not serious or that children are not likely to contract, and that children receive too many vaccines in the first two years of life (33, 64).

The increase in the number of vaccines recommended for administration to young children and the increased number of vaccines required for school entry have clearly played a role in parents’ concerns about vaccination. Access to information on the Internet, including a large volume of non-evidence-based material from sources that propagate misinformation about vaccines, can also play an important role, particularly because judging the validity and reliability of these sources of vaccine information can be difficult. Finally, a small percentage of parents cite religious objections to vaccination, arguing that vaccination is against the will of God or reflects a lack of faith in God. Some organized religions oppose specific vaccines (rubella, hepatitis A, varicella) because they were developed from viral strains obtained from human fetuses that had been intentionally aborted or the strains were attenuated through successive passes in human diploid fibroblast cultures that came from aborted fetuses.



## IMPACT OF SCHOOL VACCINE LAW EXEMPTIONS ON DISEASE INCIDENCE

Good evidence has shown that laws requiring vaccination prior to school entry increase vaccination rates and correspondingly decrease the incidence of vaccine-preventable disease. A 1999 review of six regional and three national studies concluded that “. . .sufficient scientific evidence exists that vaccination requirements for child care, school, and college attendance are effective in improving vaccination coverage and immunity and/or in reducing rates of disease” (3, p. 104). A 1977 study by the Centers for Disease Control and Prevention (CDC) found that states with laws that required vaccination for school entry experienced measles incidence rates that were 40–50% lower than those in states without such laws (7).

Other good evidence has shown that allowing exemptions to vaccine requirements decreases vaccination rates and increases disease outbreaks and that the type of exemption allowed, enforcement of requirements, and ease with which exemptions can be obtained all have an impact on disease incidence (6, 34). Feikin and colleagues (22) found that school-age children (3–18 years old) in Colorado who had been granted exemptions from vaccination were 22 times more likely to contract measles and 6 times more likely to acquire pertussis than were immunized children. Among 3–10-year-old children, the risk of contracting measles was increased more than 60-fold, and the risk of contracting pertussis was increased more than 16-fold among exempted children as compared with immunized children. In two other studies, children of vaccine-refusing parents had a 9-fold higher risk of contracting varicella (26) and a 23-fold higher risk for pertussis (25) than did children of vaccine-accepting parents.

Salmon and colleagues (53) performed a cohort study of 5–19-year-olds between 1985 and 1992 to determine the relative risk of contracting measles for those children who had been exempted from school vaccine requirements compared with those who had been vaccinated. They found that exemptors were, on average, 35 times more likely to contract measles than vaccinated individuals. They also determined that exempt populations tended to be clustered geographically, increasing the risk of disease spread within those communities. Using a mathematical model, they determined that as the number of exemptors in a community increases, the incidence of measles among the nonexempt population would also increase. In a separate study, Feikin and colleagues (22) found that at least 11% of vaccinated children in measles outbreaks acquired their infection through contact with an exemptor.

Because unvaccinated children often cluster geographically, even in a relatively well-immunized community, disease can spread because of the proximity of those who are unimmunized to each other. Omer and colleagues (41) reported significant geographic clustering of exemptors in Michigan and overlap between clusters of exemptors and clusters of reported pertussis cases among children. Children whose families belong to religions that oppose vaccination or whose parents possess certain health beliefs often live near each other and attend the same schools, enabling the spread of disease among unvaccinated children during an outbreak (58). This phenomenon has been illustrated by several large outbreaks of measles and rubella that have occurred among Amish and Mennonite communities and in Christian Science schools (5).

During the first 7 months of 2008, 131 cases of measles were reported to the CDC, including 15 patients requiring hospitalization. Of these, 112 were either unvaccinated or had unknown vaccination status, 95 of whom were eligible for vaccination. Of the 95 who were eligible for vaccination, two-thirds were unvaccinated because of religious or philosophical beliefs (8).

Omer and colleagues (40) examined the relationship between state-level rates of nonmedical exemptions at school entry and pertussis incidence rates in each state. They found that from 2001 to 2004, states that permitted personal belief exemptions had higher rates of nonmedical

exemption at school entry than did states that offered only religious exemptions (incidence ratio 1.48), and that states with easier processes for obtaining an exemption had higher exemption rates over time and rates of pertussis that were 90% higher than those in states with difficult exemption processes. Similarly, a study examining the relationship between exemption rates and pertussis at the county level in New York State between 2000 and 2011 (30) found that counties with overall exemption rates of 1% or greater reported a higher incidence of pertussis than did counties with exemption rates below 1%. Overall, the incidence of pertussis increased by 5 cases per 100,000 for each 0.1% increase in the exemption rate. Notably, the risk of pertussis infection increased among both vaccinated and exempted children in counties with exemption rates of 1% or greater.

Robbins and colleagues (50) demonstrated that states with the lowest incidence of measles were more likely to have laws covering school attendance for all grades, not simply those first entering the school in kindergarten or first grade. States with the lowest measles incidence were also more likely to enforce their laws.

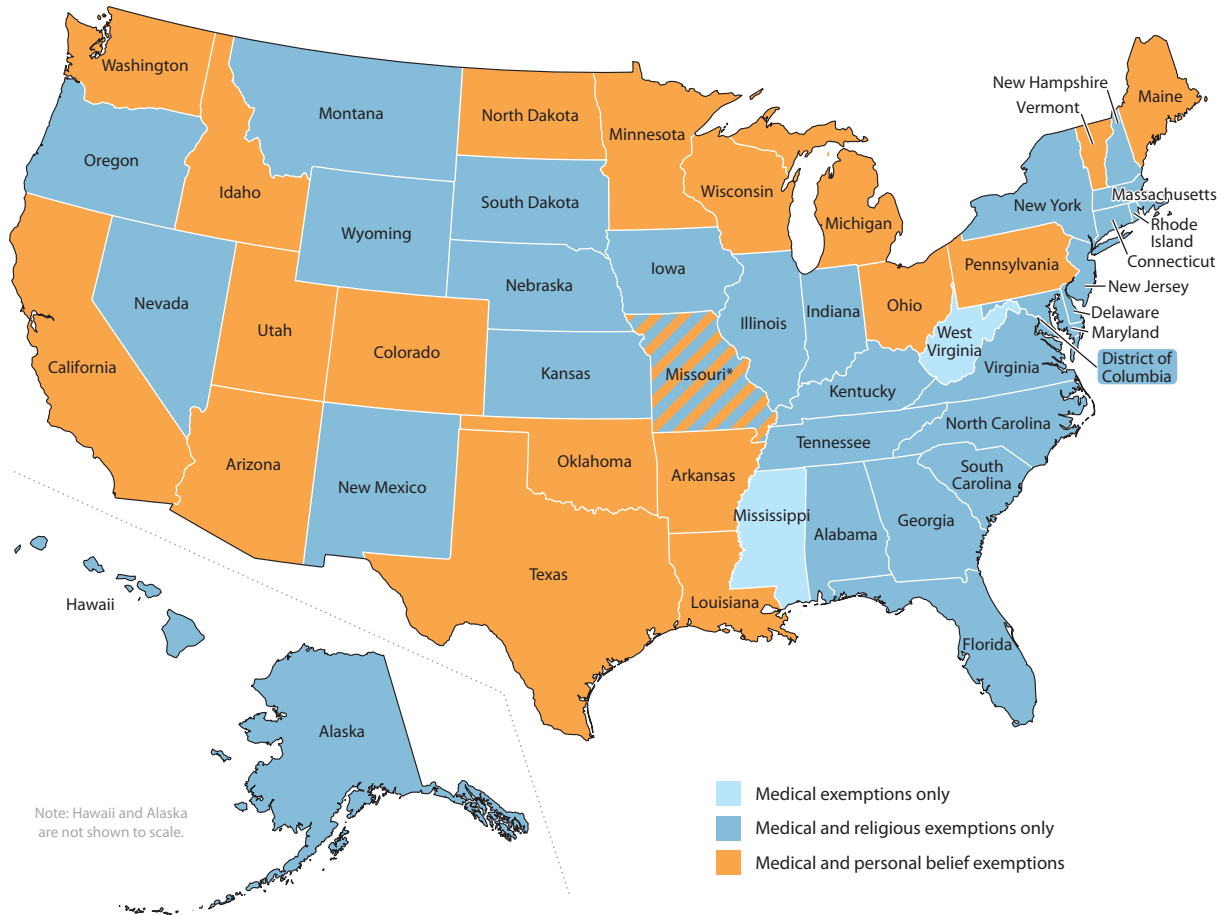
## STATE VARIATION IN EXEMPTION RATES AND REQUIREMENTS

The cornerstone of vaccine policy in all 50 states is the vaccination requirement for school entry. School entry requirements vary widely from state to state, both in terms of the kinds of exemptions allowed and the ease with which an exemption can be obtained. All states allow exemptions for medical reasons, whereas 48 states allow exemption for religious reasons and 18 for personal (nonreligious) beliefs (see **Figure 1**). Missouri allows a personal belief exemption to its vaccine requirement for day care, preschool, and nursery school but requires a medical or religious reason for kindergarten and above. Mississippi and West Virginia allow only medical exemptions (38).

Exemption rates vary widely (10, 11); Mississippi reported exemption rates among kindergarten enrollees of less than 0.1% and Alaska reported a 7% exemption rate (5.7% nonmedical exemption rate; 1.3% medical exemption rate) during the 2011–2012 school year (11). At the county level, exemption rates can vary even more. The state of Washington, for example, reported a statewide exemption rate of 5.6% for students enrolled in kindergarten through twelfth grade during the 2011–2012 school year. Exemption rates by county, however, ranged between 1% (Garfield) and 30% (Ferry), with exemption rates exceeding 10% in 7 of 37 counties reporting data (63). This variation in exemption rates is likely due to many factors, including shared beliefs and concerns of individuals living in smaller communities, the ease with which medical and personal belief exemptions can be obtained, and the variation between states, and even school districts, with regard to enforcement of school entry laws.

The ease with which medical exemptions are granted varies from state to state and can include any or all of the following: a written statement from a physician, a requirement that the physician practice in-state, a separate medical exemption form, approval from the health department, annual approval, and notarization of the exemption forms. Stadlin and colleagues (57) evaluated a total of 87,631 medical exemptions granted over seven school years. Compared with states with difficult medical exemption criteria, medical exemption rates were considerably higher in states with easy [adjusted incidence rate ratio (IRR) 6.4] or medium (adjusted IRR 4.4) criteria. Medical exemption rates were twice as high in states that offered permanent medical exemptions as compared with those that required periodic re-exemption. The highest rate of medical exemptions was found in states that had rigorous nonmedical exemption criteria and easy medical exemption criteria, suggesting that some parents seek medical exemptions for their children if they cannot obtain a personal belief or religious exemption as easily.

Of the 30 states (and the District of Columbia) that allow exemptions only for medical or religious reasons, the requirement for religious exemption can be as narrow as requiring membership



**Figure 1**

State exemptions from school vaccination requirements. Source: Reference 38. \*Missouri's personal belief exemption applies only to day care, preschool, and nursery school.

in a recognized religious group with an authentic objection to vaccination or as broad as requiring only a “genuine and sincere religious belief.” The rate of parents seeking a personal belief exemption has been rising in recent years. Between 1991 and 2004, personal belief exemptions to school vaccine requirements increased from 0.99% to 2.45% in the United States (40). Evidence also indicates that religious exemptions have been rising in some states that do not offer a personal belief exemption but that define religion broadly. In Oregon, for example, where a religion is defined as “any system of beliefs, practices, or ethical values” and religious exemption requires parents to sign a statement that their child is “being reared as an adherent to a religion the teachings of which are opposed to such immunization,” the religious exemption rate has increased from 2.4% in 2001–2002 to 5.8% in 2011–2012, with exemption rates as high as 12% in one county, and some schools reporting religious exemption rates as high as 77% (45).

Exemption rates rise considerably in states that offer personal belief exemptions. In 2003, Arkansas implemented a personal belief exemption process (they previously had allowed only medical exemptions). In the 4 years following the implementation of that change, the number of

exemptions rose by a factor of 2.6, despite a drop in the absolute number of medical exemptions over that time period (60).

The ease with which a personal belief exemption can be obtained also appears to have a substantial effect on exemption rates. Rota and colleagues (52) surveyed state health department immunization program managers of the 48 states offering nonmedical exemptions to school vaccine entry requirements. Assigning categories to define the amount of effort required to obtain a nonmedical exemption, the authors found that states that required little effort to obtain an exemption (a simple signature from one parent on a form obtained from the school with no extra visits required) had higher rates of vaccine exemption requests than did states that required more effort to obtain an exemption (notarized signature, form obtained from health department, additional signature from state or religious official). They concluded that, in many states, the process for obtaining a vaccine exemption required less effort than fulfilling vaccination requirements. This study was replicated in 2013 by Blank and colleagues with similar findings: Mean nonmedical exemption rates for kindergartners in states with easy, intermediate, or difficult requirements for nonmedical exemption were 2.9%, 1.5%, and 1.1%, respectively (2), leading the authors to conclude that convenience plays an important role in parental decisions about whether to vaccinate a child or seek a nonmedical exemption from vaccination.

## **PERSONAL BELIEF EXEMPTIONS, FUTURE CHALLENGES, AND POSSIBLE SOLUTIONS**

The vaccination of young children against potentially serious infectious diseases serves to protect children and the communities in which they live. State laws requiring vaccination prior to school entry are essential to the effectiveness of vaccination programs. School vaccination laws provide an incentive to parents who might not otherwise make the effort to vaccinate their children.

Significant opposition to school vaccination requirements continues, and personal belief exemptions may, somewhat paradoxically, help optimize vaccination rates by providing a way for parents with strongly held beliefs to opt out of the requirement. Although eliminating exemptions for religious and personal beliefs would almost certainly increase vaccination rates and serve the goal of maximizing protection from vaccine-preventable disease in the short term, this strategy risks a backlash against school vaccination requirements that could ultimately undermine these laws (55). Some commentators have argued further that unless the exemption rate rises to a level that poses a significant risk of harm to others in the community (through the loss of herd immunity), eliminating exemptions for those with strong philosophical or religious beliefs about vaccination would not be ethically defensible (43, 51). However, the data clearly show that the existence of personal belief exemptions decreases vaccination rates and that easily obtained personal belief exemptions decrease vaccination rates more than do those requiring greater effort. The public health challenge is to identify effective strategies for increasing vaccination rates among schoolchildren within the context of state laws that allow personal belief exemptions. Revising state laws to strengthen the vaccination requirement for school attendance, while still allowing for personal belief exemptions, may be the best way to optimize vaccination rates among schoolchildren. Within those constraints, the following strategies should be considered.

### **Increasing the Difficulty of Obtaining a Personal Belief Exemption**

In most states, the process of obtaining a vaccine exemption requires considerably less effort than fulfilling vaccination requirements, and the ease with which a personal belief exemption is obtained is directly correlated with the rate at which parents seek an exemption (2, 52). Making receipt of

a personal belief exemption more difficult is one reasonable solution to rising rates of exemption (19, 48). Exemptions should not offer the path of least resistance for parents, and the exemption process should not be easier or less costly than the vaccination process. Any additional effort should also have educational value and encourage parents to carefully consider their decision. Parents seeking any exemption from school entry requirements should be required to visit a licensed health care provider and obtain a signed affidavit stating that the parent has received counseling about the importance of immunization to the individual and community, the potential consequences of not vaccinating their child, the scientific basis for vaccine safety, and the risks posed by remaining unvaccinated. States might also require exemption requests to be signed by both parents (if both possess legal decision-making authority). Personal belief exemptions should require renewal annually at the beginning of the school year (including a visit to a health care provider for counseling). Although such measures are unlikely to change the decision of the most resistant parents, they would eliminate many exemptions sought because of convenience rather than conviction (19, 56).

In 2011, the state of Washington strengthened its personal belief exemption law by requiring parents to have a licensed health care provider sign a certificate of exemption, verifying that the provider had given the parent or guardian information about the benefits and risks of vaccination. Early evidence suggests that this may have contributed to lower exemption rates. Whereas the statewide exemption rate was 6.2% for the 2009–2010 school year and 6.0% for the 2010–2011 school year, the rate for the 2011–2012 school year (the first year the new law applied) dropped to 4.7% (63). The law does not require an office visit and might be strengthened by adding that requirement. As of 2013, Oregon was considering a similar law.

### **Enforcing State Vaccination Laws**

Failure to enforce school vaccination laws encourages suboptimal immunization rates. Individual schools and school districts should be held accountable for upholding these requirements, not allowing students to attend until the conditions of state law have been met. School vaccination requirements are not simply a bureaucratic mandate, but a mechanism for ensuring students' safety (19). A recent example of such enforcement occurred in Prince George County, Maryland, in November 2007, where 2,300 students remained out of compliance with state law regarding vaccination and school attendance despite phone calls and home visits. A judge ordered the parents of these students to appear at a special court hearing where they would have to allow their children to be vaccinated on the spot, provide proof that they had already vaccinated their children, obtain a state-approved religious or medical exemption, make arrangements with the state allowing them to homeschool their children, or face the possibility of a fine or jail sentence (for truancy) (18).

### **Connecting Exemptors' School Attendance with Vaccination Rates and Disease Outbreaks**

The risk to other schoolchildren posed by the presence of unvaccinated children increases as vaccination rates within the school fall and as vaccine-preventable disease prevalence increases within the community. Several strategies may minimize this risk. First, children exempted from vaccination requirements should be excluded from school following a known exposure to any vaccine-preventable illness against which they are not vaccinated. This is already common practice in most states, but states could also consider excluding children from school if community prevalence of a vaccine-preventable illness against which the child is not vaccinated exceeds a certain level. Finally, states could consider excluding children with nonmedical exemptions from

school when vaccination rates at the school fall below a level that threatens herd immunity for a given antigen. An alternative, simpler, approach would be to set a certain level for all vaccines (3–5%). Nonmedical exemptors would be excluded from school until either they were vaccinated against the antigen in question or an adequate rate of vaccination was achieved within the school. Such a bill was introduced into the Vermont legislature in 2013, proposing to suspend the philosophical and religious exemptions for any vaccine if the immunization rate at a school for that specific vaccine falls below 90%.

### **Expand the Vaccine Requirement to Day Care and Preschool**

Not all states require vaccination for attendance in day care and preschool. State laws that require vaccination prior to school entry do not assure that younger children are vaccinated on time and therefore do not serve to protect children under 5 years of age, the period during which they are most vulnerable to many vaccine-preventable diseases and the resulting serious consequences. This concern has emerged as greater numbers of parents use nonstandard vaccination schedules, delaying at least some vaccines. Dempsey and colleagues (16) found that although only 2% of parents refused all vaccines for their young children, 13% were using some type of nonstandard vaccination schedule. These parents felt that delaying or skipping vaccines was safer than following the regular vaccine schedule. Although school vaccine laws encourage many of these parents to complete the vaccine series by school entry, they do not solve the problem of vaccine delay and schedules that result in children being underimmunized. Adding a requirement for day care and preschool programs protects at least some of these children and makes the day care and preschool environments safer.

### **Carefully Selecting which Vaccines to Require for School Attendance**

Although every vaccine administered during childhood has the potential to protect the individual child, and most vaccines reduce the likelihood of community outbreaks, decisions about which vaccines to require for school entry should be carefully considered. The increasing number of vaccines recommended during childhood increases parental resistance to vaccination, and states should consider limiting the school vaccine requirement to those vaccines that are the most important and most relevant to the school environment. Most states consider issues related to vaccine effectiveness, safety, and cost in establishing vaccination requirements, but justifying a requirement for a given vaccine for school entry should also require that the vaccine prevents a disease that causes significant morbidity and/or mortality, reduces person-to-person spread of disease, and bears some relationship to increasing safety within the school environment (44). Traditionally, vaccines required for school entry have been for those diseases that are easily spread by casual contact, the kind that normally occurs between schoolchildren pursuing sanctioned activities at the school. The HPV vaccine would probably not meet this criterion because the primary mode of transmission is via sexual contact, and schoolchildren are not placed at significant risk of contracting HPV simply by encountering unvaccinated individuals at school (44). In fact, attempts to add the HPV vaccine to school attendance requirements has met with significant resistance, in part because of the sexually transmitted nature of the infection and the nontransmissibility of HPV in the classroom setting, leading most states away from adding the vaccine to the list of those required for school attendance (14). With the increasing number of vaccines, school mandates must be considered carefully and reserved for those diseases that are easily spread and represent significant threats to schoolchildren (29). Attempts to require vaccines that do not have some direct relevance to the classroom environment risks undermining laws that require vaccination



of children who attend school. It also carries the risk that some parents may seek personal belief exemptions from all vaccinations even though their opposition is primarily to one vaccine.

## CONCLUSION

School vaccine requirements are an essential tool in the fight to protect children and communities from the dangers of vaccine-preventable infections. Personal belief exemptions provide an alternative for children whose parents have strong beliefs about vaccination and also serve to decrease resistance to school vaccination laws. Nonetheless, when the rate of personal belief exemptions at a given school rises to a level at which herd immunity is impaired, some children are placed at risk by those whose parents have chosen not to vaccinate. Public health officials and state legislators should carefully consider how to balance the competing goals of individual freedom and community welfare in such a way that some individual freedom can be tolerated without substantially increasing the risk to other children attending school, including children with impaired immunity from underlying medical conditions. Strengthening enforcement of existing laws, increasing the difficulty of obtaining a personal belief exemption, restricting school attendance of exemptors when vaccination rates fall to an unacceptable level, expanding vaccine requirements to day care and preschool programs, and carefully considering which vaccines to include as school requirements may all play a role in achieving the proper balance. Finally, reducing barriers to vaccination (financial and logistical) and expanding the use of social messaging that emphasizes the importance of high vaccination rates to protect the health of children attending school may encourage reluctant parents to vaccinate their children (19, 27).

## DISCLOSURE STATEMENT

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

## LITERATURE CITED

1. Baldwin P. 1999. *Contagion and the State in Europe, 1830–1930*. Cambridge, UK: Cambridge Univ. Press
2. Blank NR, Caplan AL, Constable C. 2013. Exempting schoolchildren from immunizations: states with few barriers had highest rates of nonmedical exemptions. *Health Aff.* 32(7):1282–90
3. Briss PA, Rodewald LE, Hinman AR, Shefer AM, Strikas RA, et al. 2000. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. *Am. J. Prev. Med.* 18:97–140
4. *Brown v. Stone*, 378 So. 2d 218, 224 (Miss. 1979)
5. Calandrillo SP. 2004. Vanishing vaccinations: Why are so many Americans opting out of vaccinating their children? *Univ. Mich. J. Law Reform* 37(2):353–440
6. CDC (Cent. Dis. Control. Prev.). 1977. Measles and school immunization—Alaska. *MMWR* 26(11):85–86
7. CDC (Cent. Dis. Control. Prev.). 1977. Measles—United States. *MMWR* 26(14):109–11
8. CDC (Cent. Dis. Control. Prev.). 2008. Update: measles—United States, January–July, 2008. *MMWR* 57(33):893–96
9. CDC (Cent. Dis. Control. Prev.). 2009. Invasive *Haemophilus influenzae* type b disease in five young children—Minnesota, 2008. *MMWR* 58(3):58–60
10. CDC (Cent. Dis. Control. Prev.). 2011. Vaccination coverage among children in kindergarten—United States, 2009–10 school year. *MMWR* 60:700–4
11. CDC (Cent. Dis. Control. Prev.). 2012. Vaccination coverage among children in kindergarten—United States, 2011–12 school year. *MMWR* 61(33):647–52

12. Colgrove J. 2005. "Science in a Democracy": the contested status of vaccination in the progressive era and the 1920s. *Isis* 96:167–91
13. Colgrove J. 2006. *State of Immunity: The Politics of Vaccination in Twentieth-Century America*. Berkeley: Univ. Calif. Press
14. Colgrove J, Abiola S, Mello MM. 2010. HPV vaccination mandates—lawmaking amid political and scientific controversy. *N. Engl. J. Med.* 363(8):785–91
15. Dayan GH, Ortega-Sánchez IR, LeBaron CW, Quinlisk MP, Iowa Measles Resp. Team. 2005. The cost of containing one case of measles: the economic impact on the public health infrastructure—Iowa, 2004. *Pediatrics* 116:e1–4
16. Dempsey AF, Schaffer S, Singer D, Butchart A, Davis M, Freed GL. 2011. Alternative vaccination schedule preferences among parents of young children. *Pediatrics* 128(5):848–56
17. Diekema DS. 2004. Parental refusals of medical treatment: the harm principle as threshold for state intervention. *Theor. Med. Bioeth.* 25(4):243–64
18. Diekema DS. 2008. Public health, ethics, and state compulsion. *J. Pub. Health Manage. Pract.* 14(4):332–34
19. Diekema DS. 2012. Improving childhood vaccination rates. *N. Engl. J. Med.* 366(5):391–93
20. Diekema DS, Marcuse EK. 2007. Ethical issues in the vaccination of children. In *Public Health Ethics: Theory, Policy, and Practice*, ed. R Bayer, LO Gostin, B Jennings, B Steinbock, pp. 279–88. New York: Oxford Univ. Press
21. Duffy J. 1978. School vaccination: the precursor to school medical inspection. *J. Hist. Med. Allied Sci.* 33(3):344–55
22. Feikin DR, Lezotte DC, Hamman RF, Salmon DA, Chen RT, Hoffman RE. 2000. Individual and community risks of measles and pertussis associated with personal exemptions to immunization. *JAMA* 284:3145–50
23. Feinberg J. 1986. *Harm to Self: The Moral Limits of the Criminal Law*. New York: Oxford Univ. Press
24. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. 2010. Parental vaccine safety concerns in 2009. *Pediatrics* 125(4):654–59
25. Glanz JM, McClure DL, Magid DJ, Daley MF, France EK, et al. 2009. Parental refusal of pertussis vaccination is associated with an increased risk of pertussis infection in children. *Pediatrics* 123(6):1446–51
26. Glanz JM, McClure DL, Magid DJ, Daley MF, France EK, Hambidge SJ. 2010. Parental refusal of varicella vaccination and the associated risk of varicella infection in children. *Arch. Pediatr. Adolesc. Med.* 164(1):66–70
27. Hershey JC, Asch DA, Thumasathit T, Meszaros J, Waters VV. 1994. The roles of altruism, free riding, and bandwagoning in vaccination decisions. *Organ. Behav. Hum. Decis. Process.* 59:177–87
28. Hodge JG, Gostin LO. 2001–2002. School vaccination requirements: historical, social, and legal perspectives. *Ky. Law J.* 90:831–90
29. Horlick G, Shaw FE, Gorji M, Fishbein DB, Work. Group Legis. Vaccin. Adolesc. Health. 2008. Delivering new vaccines to adolescents: the role of school-entry laws. *Pediatrics* 121(Suppl. 1):S79–84
30. Imdad A, Tserenpuntsag B, Blog DS, Halsey NA, Easton DE, Shaw J. 2013. Religious exemptions for immunization and risk of pertussis in New York State, 2000–2011. *Pediatrics* 132(1):37–43
31. *Jacobson v. Mass.*, 197 US 11 (1905)
32. Jackson CL. 1969. State laws on compulsory immunization in the United States. *Public Health Rep.* 84(9):787–95
33. Kennedy AM, Brown CJ, Gust DA. 2005. Vaccine beliefs of parents who oppose compulsory vaccination. *Public Health Rep.* 120:252–58
34. Lantos JD, Jackson MA, Opel DJ, Marcuse EK, Myers AL, Connelly BL. 2010. Controversies in vaccine mandates. *Curr. Probl. Pediatr. Adolesc. Health Care* 40:38–58
35. Leavitt JW. 2003. Public resistance or cooperation? A tale of smallpox in two cities. *Biosecur. Bioterror.* 1(3):185–92
36. *McCarthy v. Boozman*, 212 F Supp. 2d 945 (WD Ark. 2002)
37. Mill JS. 1956. *On Liberty*. Indianapolis, IN: Bobbs-Merrill
38. NCSL (Nat. Conf. State Legis.). 2012. *States with Religious and Philosophical Exemptions from Immunization Requirements, December 2012*. Washington, DC/Denver, CO: NCSL. <http://www.ncsl.org/issues-research/health/school-immunization-exemption-state-laws.aspx>

39. Novak A. 2005. The religious and philosophical exemptions to state-compelled vaccination: constitutional and other challenges. *J. Const. Law* 7(4):1101–29
40. Omer SB, Pan WK, Halsey NA, Stokley S, Moulton LH, et al. 2006. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. *JAMA* 296(14):1757–63
41. Omer SB, Enger KS, Moulton LH, Halsey NA, Stokley S, Salmon DA. 2008. Geographic clustering of nonmedical exemptions to school immunization requirements and associations with geographic clustering of pertussis. *Am. J. Epidemiol.* 168:1389–96
42. Omer SB, Salmon DA, Orenstein WA, deHart P, Halsey N. 2009. Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. *N. Engl. J. Med.* 360(19):1981–88
43. Opel DJ, Diekema DS. 2012. Finding the proper balance between freedom and justice: why we should not eliminate personal belief exemptions to vaccine mandates. *J. Health Policy Polit. Law* 37(1):141–47
44. Opel DJ, Diekema DS, Marcuse EK. 2008. A critique of criteria for evaluating vaccines for inclusion in mandatory school immunization programs. *Pediatrics* 122:e504–10
45. Or. Immun. Progr., Or. Health Auth. 2013. *Immunization requirements for school and child-care*. Or. Immun. Progr., Portland, Or. <http://public.health.oregon.gov/PreventionWellness/VaccinesImmunization/GettingImmunized/Pages/school.aspx>
46. Orenstein WA. 2006. The role of measles elimination in development of a national immunization program. *Pediatr. Infect. Dis. J.* 25:1093–101
47. Orenstein WA, Hinman AR. 1999. The immunization system in the United States—the role of school immunization laws. *Vaccine* 17(Suppl. 3):S19–24
48. *Pediatr. Infect. Dis. Soc., Vaccine Advocacy Comm.* 2011. A statement regarding personal belief exemption from immunization mandates. *Pediatr. Infect. Dis. J.* 30(7):606–7
49. *Prince v. Commonw. Mass.*, 321 US 158 (1944)
50. Robbins KB, Brandling-Bennett AD, Hinman AR. 1981. Low measles incidence: association with enforcement of school immunization laws. *Am. J. Public Health* 71:270–74
51. Ross LF, Aspinwall TJ. 1997. Religious exemptions to the immunization statutes: balancing public health and religious freedom. *J. Law Med. Ethics.* 25:202–9
52. Rota JS, Salmon DA, Rodewald LE, Chen RT, Hibbs BF, Gangarosa EJ. 2001. Processes for obtaining nonmedical exemptions to state immunization laws. *Am. J. Public Health* 91:645–48
53. Salmon DA, Haber M, Gangarosa EJ, Phillips L, Smith NJ, Chen RT. 1999. Health consequences of religious and philosophical exemptions from immunization laws: individual and societal risk of measles. *JAMA* 282(1):47–53
54. Salmon DA, Moulton LH, Omer SB, deHart MP, Stokley S, Halsey NA. 2005. Factors associated with refusal of childhood vaccines among parents of school-aged children. *Arch. Pediatr. Adolesc. Med.* 159:470–76
55. Salmon DA, Sapsin JW, Teret S, Jacobs RF, Thompson JW, et al. 2005. Public health and the politics of school immunization requirements. *Am. J. Public Health* 95(5):778–83
56. Salmon DA, Siegel AW. 2001. Religious and philosophical exemptions from vaccination requirements and lessons learned from conscientious objectors from conscription. *Public Health Rep.* 116:289–95
57. Stadlin S, Bednarczyk RA, Omer SB. 2012. Medical exemptions to school immunization requirements in the United States—association of state policies with medical exemption rates (2004–2011). *J. Infect. Dis.* 206(7):989–92
58. Sugerman DE, Barskey AE, Delea MG, Ortega-Sanchez IR, Bi D, et al. 2010. Measles outbreak in a highly vaccinated population, San Diego, 2008: role of the intentionally undervaccinated. *Pediatrics* 125(4):747–55
59. Swales JD. 1992. The Leicester anti-vaccination movement. *Lancet* 340:1019–21
60. Thompson JW, Tyson S, Card-Higginson P, Jacob RF, Wheeler G, et al. 2007. Impact of addition of philosophical exemptions on childhood immunization rates. *Am. J. Prev. Med.* 32(3):194–201
61. *Vaccination is the curse of childhood.* (Antivaccination circular distributed in Boston during a smallpox epidemic). 1901. Countway Libr. Med., Harvard Univ. <http://pds.lib.harvard.edu/pds/view/5817279?n=1&imagesize=1200&jp2Res=.25&mo;printThumbnails=no>

62. Walkinshaw E. 2011. Mandatory vaccinations: the Canadian picture. *CMAJ* 183(16):E1165–66
63. Wash. State Dep. Health. 2013. *School immunization status data reports*. Wash. State Dep. Health, Olympia. <http://www.doh.wa.gov/DataandStatisticalReports/SchoolImmunization/DataReports.aspx>
64. Wenger OK, McManus MD, Bower JR, Langkamp DL. 2011. Underimmunization in Ohio's Amish: Parental fears are a greater obstacle than access to care. *Pediatrics* 128(1):79–85
65. Willrich M. 2011. *Pox: An American History*. New York: Penguin
66. *Workman v. Mingo County Board of Education*, 667 F. Supp. 2d 679 (2009)
67. *Wright v. DeWitt School District*, 238 Ark. 906, 385 S.W. 2d 644 (Ark. 1965)
68. *Zucht v. King*, 260 US 174 (1922)