

**ANALYSIS OF MANDATORY YOUTH VACCINATION ENFORCEMENT
MODELS**

by

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ABSTRACT

Routine vaccinations are one of the most significant public health achievements of the 20th century, yet maintaining high vaccination rates is an ongoing public health challenge. Recently, some areas in the United States have seen decreases in youth vaccination rates, which may put communities at risk of communicable disease outbreaks given the public health importance of youth vaccination. This essay analyzes the relationship between school enforcement of mandatory youth vaccination policies and youth vaccination rates. Each state's youth vaccination laws and regulations were analyzed, and states were categorized based on the strength of their exemption and enforcement policies. These categories of enforcement were then regressed with MMR vaccination rate data from the 2014-2015 school year. This state-level analysis of enforcement variables does not demonstrate a statistically significant relationship between the strength of a state's enforcement policies and its MMR vaccination rate. However, local-level studies using surveys and interviews with school administrators indicate a significant relationship between enforcement and vaccination rates. Additional research is needed to further explore the impact of school enforcement policies on youth vaccination rates to better understand how these policies can be amended to increase coverage rates.

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1
2.0 OVERVIEW OF MANDATORY YOUTH VACCINATION IN THE UNITED STATES	3
3.0 REVIEW OF LITERATURE.....	8
3.1 YOUTH IMMUNIZATION ENFORCEMENT IN THE MEDIA	11
4.0 STATE YOUTH VACCINATION POLICY COMPARISONS AND ANALYSIS	14
4.1 DATA COLLECTION METHODOLOGY	14
4.2 ANALYSIS OF SCHOOL IMMUNIZATION EXEMPTIONS	16
4.3 ANALYSIS OF EXEMPTION ACCESSIBILITY	17
4.4 ANALYSIS OF ENFORCEMENT OF SCHOOL COMPLIANCE.....	20
5.0 THE EFFECT OF ENFORCEMENT ON VACCINATION RATES.....	24
5.1 POLICY IMPLICATIONS	25
6.0 SUMMARY	27
APPENDIX A: MMR VACCINATION RATES FOR THE 2014-2015 SCHOOL YEAR.	28
APPENDIX B: REGRESSION OUTPUT	30
BIBLIOGRAPHY	31

LIST OF TABLES

Table 1. Youth Immunization Exemption Accessibility Models...**Error! Bookmark not defined.**

Table 2. Enforcement of School Compliance Models 21

No table of figures entries found.

LIST OF FIGURES

Figure 1. Youth Immunization Exemption Type Map.....	17
Figure 2. Youth Immunization Exemption Accessibility Map.....	19
Figure 3. Enforcement of School Compliance Map	22

1.0 INTRODUCTION

This report analyzes school enforcement of mandatory youth immunization laws and the potential impact different approaches to enforcement may have on youth vaccination rates. Mandatory vaccination laws have significantly contributed to the decrease of communicable disease since the 20th century. However, some areas in the United States have recently seen decreases in youth vaccination rates. In order to maintain high vaccination rates, public health officials must understand the systems and variables that affect whether or not a child receives recommended routine vaccinations. Research on mandatory youth immunization laws often focuses on the types of exemptions states permit in their statutes. However, there is minimal research on the systems and policies in place in each state to enforce compliance with immunization laws. School officials play a vital role in enforcing students' compliance with mandatory immunization laws, yet few studies consider the challenges to this aspect of the system. The following research aims to develop a better understanding of each state's enforcement policies, auditing procedures to review schools' compliance with state laws, and the potential impact these policies and procedures have on youth vaccination rates in the United States.

Objectives:

- Review current literature on the relationship between the enforcement of youth immunization policies and youth vaccination rates

- Compile and analyze state-level policy variables related to enforcement and auditing of schools' compliance with youth immunization policies
- Identify any significant relationships between these enforcement variables and youth vaccination rates

2.0 OVERVIEW OF MANDATORY YOUTH VACCINATION IN THE UNITED STATES

The development and widespread administration of vaccines against communicable diseases was one of the most significant public health achievements of the 20th century. Routine vaccination in the United States and abroad has greatly reduced morbidity associated with communicable disease and is also credited with the eradication of the smallpox virus (“Achievements in Public Health,” 1999). Vaccinations stimulate the production of antibodies that can prevent an individual from falling ill due to a disease or lessen the severity of the disease if they are exposed. Although some people should not receive vaccinations due to pre-existing health conditions, vaccinating many individuals in a community can protect those who are unvaccinated by creating herd immunity. Herd immunity describes a scenario in which enough people in a community are immune to a disease that even if some people contract the disease, the transmission will not lead to a widespread outbreak. While vaccination increases a person’s immunity to communicable disease, it is not the only way to develop immunity. For example, if a child has had chickenpox, which is caused by the varicella virus, they may be exempt from receiving the varicella vaccine because contracting the virus provides sufficient immunity. All state mandatory youth vaccination laws allow children to forgo vaccination if they have developed immunity from contracting the disease.

States have the authority to pass legislation that regulates individual behavior to protect the health, safety, and general welfare of citizens. In order to promote youth vaccination, state legislatures have adopted laws that require students entering schools, and in some cases daycare facilities, to provide proof of immunity as a condition of enrollment. While states use their police powers to mandate youth vaccinations, the federal government also participates in the promotion of youth vaccination through funding and research. The Vaccines for Children program provides vaccines at no cost to providers for children that meet certain eligibility criteria. The Department of Health and Human Services (DHHS) also operates the National Vaccine Injury Compensation Program, which monitors the supply of youth vaccinations and provides compensation to people who are injured by vaccines. Furthermore, state legislation often defers to recommendations from the federal Advisory Committee for Immunization Practices (ACIP) to determine which vaccines, number of doses, and schedule of doses should be mandated. The ACIP currently recommends all children and infants be vaccinated against 15 diseases unless they have a medical condition that could make vaccination detrimental to their health (“Summary of Recommendations,” 2011). School vaccination laws most often follow the ACIP’s schedule and require proof of immunization for children entering kindergarten and 7th grade. However, there is some state variation in mandatory vaccinations. For example, only Virginia, Rhode Island, and D.C. include the HPV vaccine, which the ACIP recommends all girls receive, in their mandatory vaccination requirements (“HPV Vaccine,” 2015).

The Department of Health and Human Services also collects youth immunization data from states and develops national objectives for youth immunization rates. The Centers for Disease Control (CDC) uses several types of data collection to measure youth vaccination rates by vaccine. The National Youth Immunization Survey (NIS) conducts phone surveys in all 50

states and DC to monitor the vaccination rates for infants and teens, and for influenza vaccination rates. For additional data on school vaccination rates, the CDC relies on schools to self-report immunization rates based on the records they collect from kindergarten and 7th grade enrollees, as well as transfer students. Some states, such as Pennsylvania, require all schools to report immunization data to state officials, but other states sample schools and only report the sampled data to the CDC (“School Immunization Rate,” 2014). The data the CDC compiles can be evaluated in relation to standards established by DHHS’s *Healthy People 2020* objectives. The 2020 objectives call for 95% coverage for the vaccinations at the kindergarten level and 80% coverage for vaccinations recommended at the 7th grade level (“Immunization and Infectious Diseases,” 2016).

Despite the vital role vaccinations have played in reducing the spread of communicable disease, there has been controversy over the safety of some mandatory youth vaccines. Most notably, a now retracted study published in *The Lancet* suggested there was an association between the measles, mumps, and rubella (MMR) vaccine and the incidence of autism in children (Ahearn, 2010). The study helped to launch an anti-vaccine movement in the United States, and multiple outbreaks of measles from 2014-2015 were linked to large populations of unvaccinated individuals (“Measles Cases,” 2016). Studies have also shown that about one third of adults in the United States believe vaccinations can cause autism (“Survey,” 2014). Many youth who receive exemptions from mandatory immunization laws do receive some of the mandatory vaccinations, but abstain from others that they find medically, religiously, or philosophically objectionable (Wahlberg, 2012). Although mandatory youth immunization laws ostensibly ensure high vaccination rates, exceptions to these mandates and flawed enforcement systems may leave many children at risk.

School vaccination enforcement systems involve many actors. While state legislators adopt vaccination mandates, state and local public health and education officials are responsible for implementing the mandates. State legislators often rely on state agencies to adopt procedures for enforcing mandates. Such procedures include:

- How guardians obtain immunization exemptions
- Steps school administrators must take to exclude non-compliant youth from schools
- Processes for reporting immunization data to state agencies
- Auditing procedures for monitoring schools' compliance.

Most youth immunization mandates are enforced by school administrators who are charged with tracking students' immunization records to ensure compliance with state law. In some areas, state and local health departments participate in enforcement by providing forms for guardians seeking exemptions and auditing school enforcement.

Based on research conducted for this analysis, penalties for officials who fail to comply with enforcement policies can include both civil and criminal penalties. However, research on school enforcement of youth immunization laws did not turn up any cases in which school officials faced legal recourse due to noncompliance with vaccination enforcement policies. Another method of enforcing mandatory immunization laws is through school accreditation requirements. States have authority over accreditation of primary and secondary schools, and compliance with state immunization policies is often included in accreditation requirements. Although little research has been done on the efficacy of accreditation as a means of enforcing immunization laws, this analysis does not focus on accreditation as a means of enforcing mandatory immunizations requirements.

Policy alone is rarely sufficient to address to a problem. The efficacy of mandatory youth immunization laws relies on many levels of enforcement and compliance, and an approach that considers the entire process of developing and enforcing these mandates is essential. Although enforcement and compliance of mandatory youth immunization laws can be evaluated from many angles, this report focuses on school enforcement of immunization policies and public health authorities auditing procedures of school enforcement.

3.0 REVIEW OF LITERATURE

Before collecting data on variables that impact youth vaccination rates, a literature review was conducted to assess previous studies on the relationship between enforcement of youth immunization policies and youth vaccination rates. In addition to reviewing academic literature on the enforcement of youth immunization policies, accounts of mandatory immunization enforcement from the media were also analyzed for a more holistic view of enforcement processes and their impact on vaccination rates across the United States.

Many studies have been conducted to examine the variables that affect youth immunization policies and rates in the United States. A study of U.S. youth immunization policies from 1998-2012 found that decreasing vaccination rate trends have been an influential factor in the passage of stricter immunization policies, particularly the repeal of philosophical exemptions (Lillvis, Kirkland, and Frick, 2014). Studies on the United State's youth immunization laws have also highlighted the critical role that immunization policies, including school enforcement, play in increasing youth vaccination rates (Orenstein and Hinman, 1999). Furthermore, Walkinshaw (2011) found that enforcement of immunization laws vary greatly not only within the United States, but internationally as well. While many countries have mandatory vaccination laws, some have few, if any, enforcement policies. Wheeler and Buttenheim (2014) conducted randomized interviews with California school staff to measure their awareness and understanding of youth immunization laws. Their study found that many staff were uninformed

about youth immunization laws and concluded that school staff needs more support and information from local and state agencies to effectively enforce state policies.

A 2005 multi-state survey of school administrators found a positive correlation between school implementation of vaccination laws and youth vaccination rates (Salmon, Omer, Moulton, Stokley, deHart, Lett, ... and Halsey, 2005). The survey results showed that school-level policies such as providing written instructions on completing requirements and requiring guardians to submit more information to obtain exemptions led to fewer children receiving vaccination exemptions. Rota, Salmon, Rodewald, Chen, Hibbs, and Gangarosa (2001) also examined the complexity of obtaining non-medical exemptions and found that in most states obtaining exemptions for immunizations was easier than obtaining the mandated vaccinations. The ease of the exemption process also reflects the effort enforcement authorities (often school officials) must put forth to ensure compliance. For example, if guardians must receive education on the risks of forgoing immunization, enforcement authorities must verify that the guardians obtained the information as well as verify any required exemption forms.

The relationship between enforcement and vaccination rates has been established for decades. Middaugh and Zyla (1978) noted that following a measles outbreak among schoolchildren in Alaska in 1976, officials discovered that schools were not adequately enforcing state immunization laws. Following the outbreak, school officials focused on improving compliance with the state's immunization laws and worked to identify and exclude unvaccinated children from schools. This focus on enforcement led to a sharp increase in vaccination rates. Other studies on the spread of communicable diseases among school children have conjectured a link between enforcement and vaccination rates. An epidemiology study on the incidence of rubella in youth following the introduction of the rubella vaccine found an increase in

susceptibility to rubella in certain time periods (Schum, Nelson, Duma, and Sedmak, 1990). The authors hypothesized that schools' failure to enforce immunization laws may explain decreases in immunity to rubella, although the school system from the study did not report any changes to its enforcement policies during the observed time period.

Studies of vaccination rates in schools have shown that while mandates are influential in increasing coverage rates, other strategies may also be necessary to achieve vaccination rates high enough to establish herd immunity. Robbins, Brandling-Bennett, and Hitman (1981) found a positive correlation between strict enforcement of immunization policies and areas with low incidences of measles. Another study in Florida surveyed schools about their enforcement policies and did not find a significant relationship between enforcement and vaccination rates (Fogarty, Massoudi, Gallo, Averhoff, Yusuf, and Fishbein, 2004). However, the authors noted that the data collected on enforcement were not detailed and there were other limitations associated with the survey.

Some literature has focused on specific methods of enforcement. Although the efficacy of different types of enforcement methods has not been studied in depth, Anthony, Reed, Leff, Huffer, and Stephens (1977) found that enforcement authority in a Cincinnati district was successfully carried out through collaboration between the Board of Health and the Board of Education. Mello, Studdert, and Parnet (2015) reviewed recent amendments to California's youth immunization laws that revoked non-medical exemptions, and emphasized the role enforcement plays in ensuring non-compliant youth are not enrolled in schools. The authors recommended a revised system in which health departments take on more responsibility for enforcing immunization policies. Under this system, schools would still maintain students' immunization records, but they would notify health departments of noncompliant students and

health officials would carry out enforcement measures. The authors also noted the possibility of “willing providers” issuing medical exemptions to youth for non-medical opposition to vaccinations.

3.1 YOUTH IMMUNIZATION ENFORCEMENT IN THE MEDIA

While the academic literature on the enforcement of youth immunization laws points to enforcement as a significant variable in increasing vaccination rates, other sources, such as media reports, have also suggested a link between enforcement and coverage rates. These reports offer valuable anecdotal evidence of mandatory youth immunization enforcement processes and have revealed critical flaws in some enforcement systems.

In 2015, news outlets published investigations into school enforcement of immunization policies in Pennsylvania, Tennessee, and New York. Two reports from Pennsylvania and Tennessee demonstrated the flawed enforcement systems in place in many states. The report in Pennsylvania revealed that the immunization data schools report to state health officials may be very inaccurate due to school officials misunderstanding reporting procedures or failing to keep accurate student immunization records (Lattanzio, 2015). Immunization records play a vital role in identifying non-compliant students and, in the event of an outbreak, would be used to protect students by prohibiting unvaccinated children from attending school. In light of this flawed data collection, the Pennsylvania Department of Health implemented new policies that created training opportunities for schools on proper reporting procedures and bolstered auditing procedures to identify and investigate unusual trends in school-reported data (Lattanzio, 2015). In Tennessee, a report found that some school districts’ record-keeping processes allowed non-

compliant students to attend school unchecked (Casey, 2015). Concerned parents called for a more rigorous auditing process and oversight from the Department of Health to ensure schools comply with their enforcement responsibilities. Flawed data collection and enforcement methods not only inhibit school and public health officials' abilities to protect students' health, but also complicate studies that rely on school-reported vaccination rates.

Other reports have revealed school officials' frustration with the task of enforcing immunization policies. Although a New York investigation of low vaccination rates among private schools revealed that the trends were associated primarily with higher non-medical exemptions in private schools, one administrator was quoted as asking "If doctors say they don't have to do it, how am I supposed to tell them they have to do it?" (Goldberf and Prakash, 2015). This sentiment highlights one difficulty school officials may face when enforcing divisive public health policies.

The CDC has also studied recent trends in immunization compliance and enforcement. In a 2015 report on increasing youth vaccination rates and decreasing exemption rates, the CDC commented:

One important change from 2013 to 2014 was the number of states that provided local coverage and exemption data online. There was an increase from 18 states providing such data in 2013 to 21 states providing these data in 2014. Making this information available publicly keeps parents informed, guides vaccination policies, and strengthens immunization programs. ("State exemption levels low," 2015)

Transparency measures like publicizing immunization data keep schools accountable to the public in enforcing immunization policies. It remains unclear if such measures affect the accuracy of the data that schools collect and report.

There are significant gaps in the literature on youth vaccination and enforcement. For example, there have been no studies on the efficacy of enforcement or a comprehensive analysis of states' enforcement policies or systems, even though both academic literature and media reports suggest that enforcement of youth immunization laws can impact immunization rates. Several studies and reports question if schools, which are primarily in charge of enforcing immunization policies, are informed of state laws and regulations or their responsibilities in enforcement. School officials may not feel empowered to exercise their enforcement authority or understand the importance of immunization policies. Furthermore, when enforcement requires educators to exclude noncompliant students from attending school, this may conflict with educators' imperative to educate children. Amending enforcement systems has the potential to increase youth vaccination rates, but more research is needed on the relationship between school enforcement and vaccination rates.

4.0 STATE YOUTH VACCINATION POLICY COMPARISONS AND ANALYSIS

Previous studies and media reports of variables that influence youth vaccination rates, suggest that enforcement of school compliance with youth vaccination policies may impact youth vaccination rates. Because it is difficult to untangle enforcement variables, such as reporting and auditing procedures from other vaccination policy variables, enforcement should be analyzed in relation to other variables that may impact states' youth vaccination rates, such as the types of immunization exemptions each state permits and the accessibility of these exemptions.

4.1 DATA COLLECTION METHODOLOGY

Data were collected on the following variables related to enforcement as well as MMR vaccination rates for all 50 states and Washington, D.C.:

Relevant Laws and Regulations- a list of the state's policies related to the enforcement of mandatory youth vaccinations

Provisional Admittance- the period of time students may be provisionally admitted to a school if they have not received all required doses of each mandated vaccine

Religious Requirements- the requirements to receive a religious exemption for mandatory youth vaccinations

Philosophical Requirements- the requirements to receive a philosophical exemption for mandatory youth vaccinations

Medical Exemption Requirements- the requirements to receive a medical exemption for mandatory youth vaccinations

Enforcement Entity- the entity responsible for enforcing students' compliance with the state's mandatory youth vaccination laws

Penalties for Youth Non-Compliance- penalties for youth who do not receive the mandatory vaccinations in the required time period (e.g. denying school admission)

Auditing of Enforcement- auditing procedures to assess enforcement entities' compliance with mandatory vaccination policies

Penalties for Enforcement Entity Noncompliance- penalties for enforcement entities that do not enforce mandatory vaccination laws

MMR Vaccination Rate- percentage of kindergarteners who received the MMR (Measles, Mumps, and Rubella) vaccine in the 2014-2015 school year based on data from the CDC (see **Appendix A** for MMR rates by state) (SchoolVaxView, 2015)

Information on each state's mandatory youth immunizations policies was collected by searching state government websites for statutory and regulatory language. State statutes specify the type of exemptions permitted and provisional enrollment periods, and some statutes also include information on the enforcement authority and penalties for noncompliance. Additional policies and procedures on the requirements to obtain each type of exemption, enforcement auditing procedures, and penalties for enforcement entity noncompliance, were found on state agencies' websites and through media reports and interviews with school administrators. MMR

vaccination rates were used as the dependent variable in this analysis because MMR vaccinations are one of the most contentious mandatory vaccines. MMR rates are more variable among all states and are more likely to be impacted by exemption and enforcement policies than other vaccination rates; other mandatory vaccinations, such as Hepatitis B and Polio vaccinations, have generally high rates in all states.

4.2 ANALYSIS OF SCHOOL IMMUNIZATION EXEMPTIONS

Review of state statutes found that all but two states permit youth to obtain immunization exemptions based on non-medical objections. Mississippi and West Virginia only accept immunization exemptions if a medical professional finds a vaccine could cause harm to a child due to a medical condition. Thirty-two states allow exemptions based on both medical and religious objections, and seventeen states permit exemptions based on medical, religious, or philosophical objections (see **Figure 1.**) All states have procedures in place for guardians to file for an exemption. Schools must enforce these procedures by keeping records of exemptions and ensuring guardians have completed the necessary steps to receive an exemption and meet compliance with state laws. Therefore, data on the number of exemptions are helpful in evaluating each state's enforcement procedures and their effects on vaccination rates.

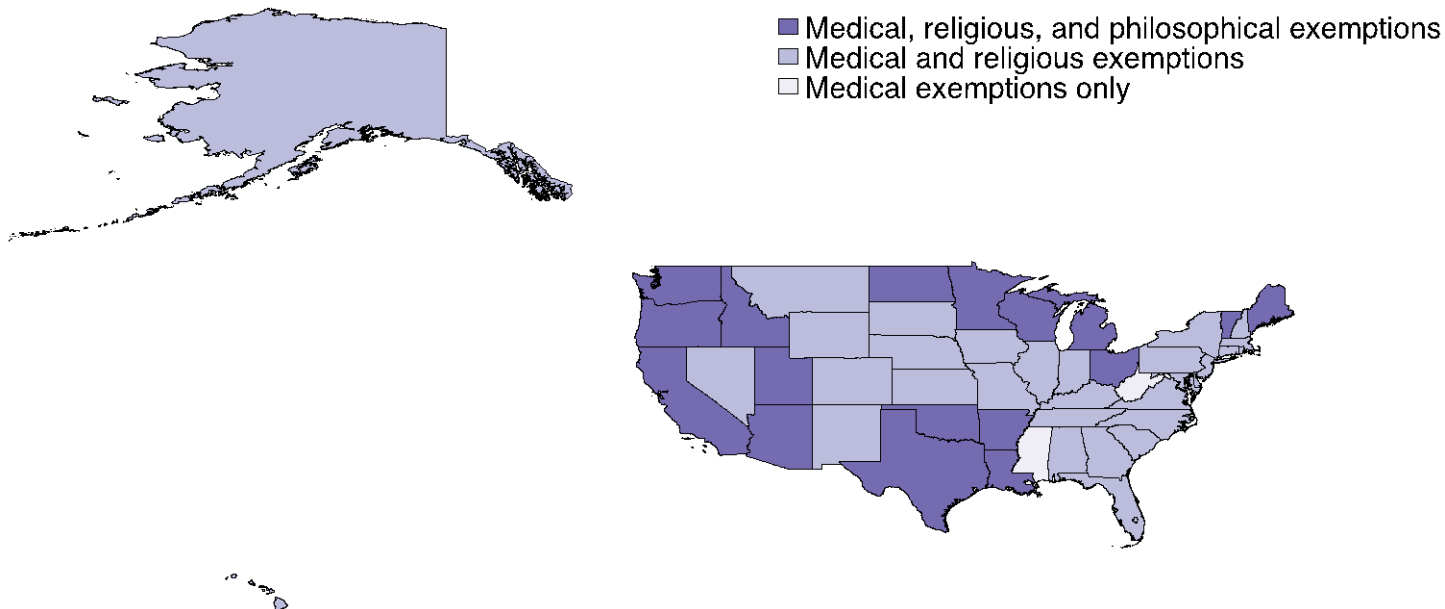


Figure 1. Youth Immunization Exemption Type Map

4.3 ANALYSIS OF EXEMPTION ACCESSIBILITY

The review of literature on enforcement and youth vaccinations established that several studies have found a positive correlation between the accessibility of vaccination exemptions and the number of exemptions granted. An analysis of each state’s process for obtaining religious and philosophical exemptions reveals that there is great variation in the accessibility of these exemptions across states, which may impact the number of students applying for non-medical exemptions. After collecting information on each state’s requirements for obtaining exemptions, the accessibility of these processes was analyzed.

States’ policies were divided into three categories (low, moderate, and high accessibility) based on the simplicity of their religious and philosophical exemption processes (see **Table 1** for

exemption accessibility models.) Accessibility was based only on religious and philosophical exemptions because there is more uniformity across states with medical exemption requirements (almost all states require a medical professional signature for medical exemptions) and medical exemption rates are less likely to be affected by procedural changes. As a result, Mississippi and West Virginia were not included in this assessment because both states only allow for medical exemptions.

Table 1. Youth Immunization Exemption Accessibility Model

Low Accessibility	Moderate Accessibility	High Accessibility
State requires some educational component on the benefits of vaccination before receiving a religious or philosophical exemption	State requires a form or statement signed by a medical or public health professional	State only requires a signed form or statement from a parent or guardian

In addition to education and signatures from medical or public health authorities, some states require forms to be notarized. Some states also require the forms to be submitted annually, while others only require a one-time submission. Although these variables may also impact the ease with which parents and guardians receive immunization exemptions on religious or philosophical grounds, they were not factored into the exemption accessibility models.

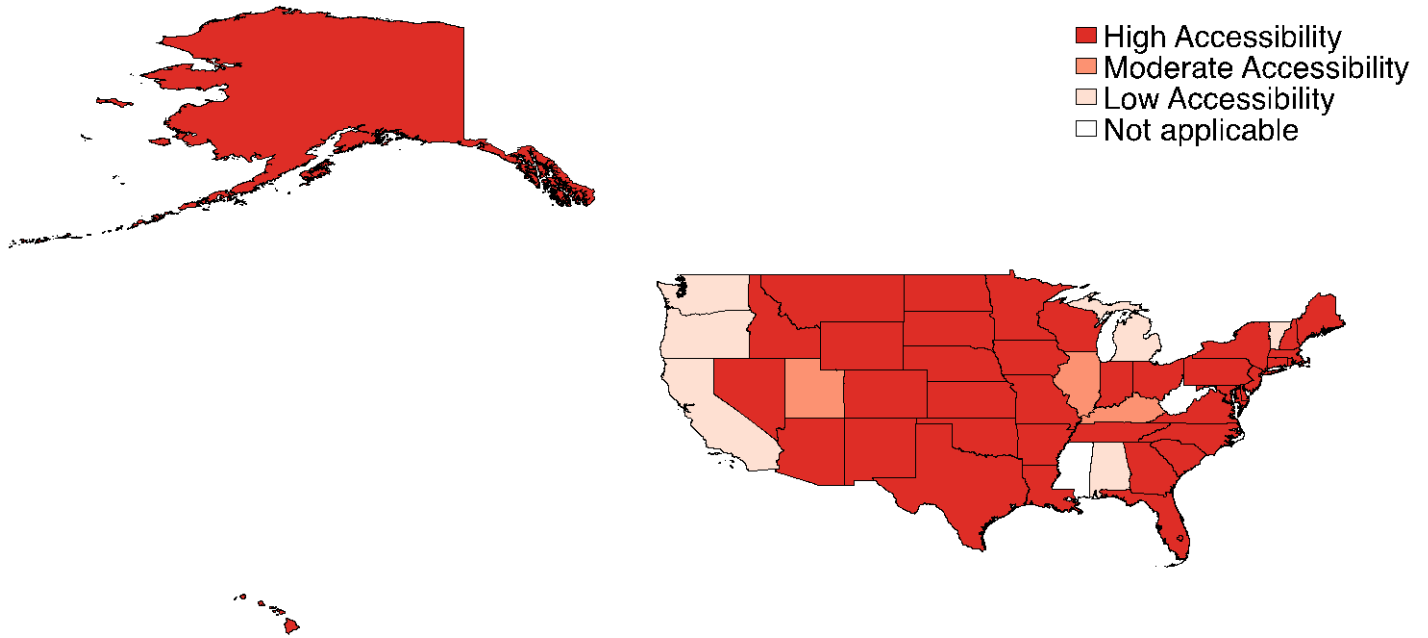


Figure 2. Youth Immunization Exemption Accessibility Map

A majority of states fell into the high accessibility model, which means their procedures for obtaining non-medical exemptions are much simpler than obtaining the required vaccinations (see **Figure 2** for exemption accessibility map.) Thirty-nine states and DC only require guardians to submit a form signed by the guardians to obtain a religious or philosophical exemption. Three states' exemption procedures were categorized as moderately accessible. Illinois, Kentucky, and Utah require guardians to acquire signatures from either a medical professional or a public health official in order to obtain a religious or philosophical exemption.

Six states (AL, CA, MI, OR, VT, and WA) have exemption processes that are minimally accessible. These states require guardians to receive some form of education on the risks and benefits of immunization in addition to submitting a signed form to school officials. The types of education include speaking with a medical professional or local health department officials, and

completing online modules on immunization. These more stringent exemption procedures have only recently been enacted, therefore their effect on non-medical exemption rates is unclear. In addition to the six states that currently require an education component in their exemption processes, several other states are currently either implementing or considering including an educational component to their non-medical exemption processes (Colorado's Personal Belief Exemption, 2013).

Although the accessibility of non-medical exemptions may influence some guardians' decision to pursue exemptions, many will likely seek exemption even when if the process is more taxing than receiving the required vaccinations. Furthermore, it is difficult to determine the extent to which schools comply with exemption processes. Some school administrators may accept exemptions that are incomplete. Nonetheless, exemption accessibility can be a lurking variable when reviewing enforcement's impact on vaccination rates, and the process also requires schools to spend more time ensuring students are in compliance.

4.4 ANALYSIS OF ENFORCEMENT OF SCHOOL COMPLIANCE

Enforcement is an important variable at multiple stages of the mandatory youth vaccination system. School officials can enforce students' and guardians' compliance with mandatory vaccination requirements, health officials can audit schools' compliance with record keeping and reporting, and education agencies can enforce accreditation and attendance policies. For this analysis, enforcement is focused on state and local health agencies' auditing and enforcement policies related to school authorities' compliance with mandatory vaccination laws. Public health agencies' enforcement procedures include auditing schools' immunization records,

publicly releasing immunization rate data by district or school, and imposing penalties for noncompliance.

Many states assign school officials sole responsibility for enforcing students’ and guardians’ compliance with youth immunization policies. While some states require health agencies to provide officials forms for immunization records and exemptions, and maintain databases for schools to report immunization data, schools are ultimately responsible for reviewing records and excluding non-compliant students from attending school. For this analysis of health agencies’ enforcement models, states’ enforcement policies were divided into three categories (low, moderate, and high enforcement) based on the reporting and auditing requirements imposed on schools (see **Table 2** for enforcement models.)

Table 2. Enforcement of School Compliance Models

Low Enforcement	Moderate Enforcement	High Enforcement
No annual reporting by schools or auditing by a public health authority	Annual reporting requirement, some auditing procedure by a public health authority	Annual reporting requirement, auditing procedures AND publicly reported data/rankings OR clear penalties for non-compliance

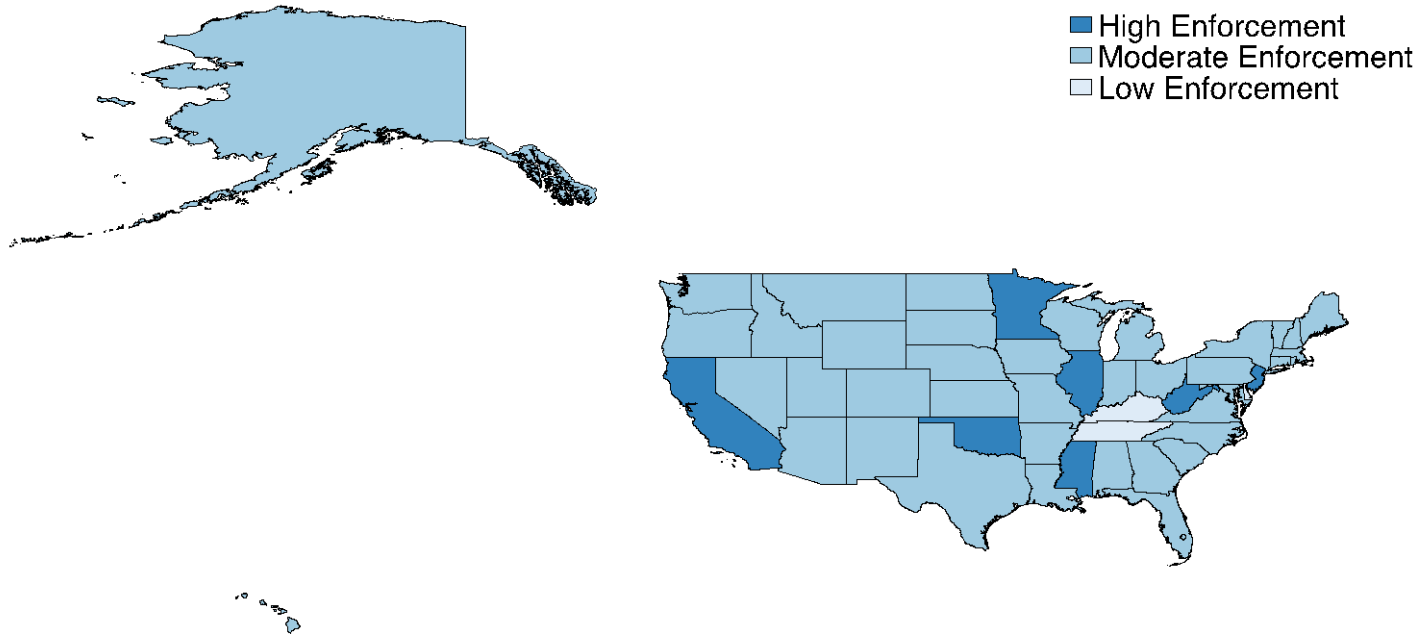


Figure 3. Enforcement of School Compliance Map

A majority of states require schools to submit annual reports to a local or state health agency that include the number of students in compliance with immunization laws, the number of students granted exemptions, and the number of students provisionally admitted or who are noncompliant. Based on these models, three states, Delaware, Kentucky, and Tennessee, and D.C. fall into the most limited enforcement category. Schools in these areas are either not required to submit annual reports on students' immunization data or are not audited by a local or state health agency (see **Figure 5** for enforcement model map.) A majority of states have moderate enforcement policies. These states require schools to submit students' aggregate youth immunization data and also have some type of auditing policies in place to monitor schools'

compliance with data collection and reporting. For example, the Pennsylvania Department of Health's auditing procedures focus on reviewing school reports and auditing only outlier data (Lattanzio, 2015).

Seven states (CA, IL, MN, MS, NJ, OK, and WV) have enforcement policies that not only require data reporting and auditing, but also enact additional enforcement measures. In addition to annual reporting requirements and auditing, several states publish schools' data on state websites for the public to view or require schools to provide immunization data to guardians if requested. The California Department of Public Health not only publishes school data publicly, but also ranks schools from "safest" to "most vulnerable" on its website based on each school's immunization rates (How Is Your School Doing?, 2015). Other states in the high enforcement category do not publish school data publicly, but do have clear penalties for school officials who do not comply with immunization policies. For example, if school officials in New Jersey do not correct deficiencies identified during an audit by the local health department, they may be subject to fine between \$50 and \$1000 per offense (Sample Enforcement Letter, 2015).

Similar to the data on states' exemption accessibility, it is difficult to assess the reliability of these enforcement measures. States' auditing procedures may not be implemented as intended. Furthermore, some state regulations call for random sampling of schools for auditing, others audit all schools, and some mention auditing but do not include clear procedures. Penalties for enforcement noncompliance also may not influence school administrators' behavior. Research on the state enforcement policies did not turn up any examples in which state administrators penalized school administrators for noncompliance with youth immunization laws.

5.0 THE EFFECT OF ENFORCEMENT ON VACCINATION RATES

Although several aforementioned studies of local enforcement of youth immunization laws found a correlation between enforcement variables, such as the accessibility of exemptions, and vaccination rates this correlation is less clear on a national scale. Regressing states' MMR rates with their provisional admittance periods, the number of exemption types available, exemption accessibility, and their enforcement models does not find produce any statistically significant relationship (see **Appendix B** for regression output.) However, the signs of the coefficients are what would be expected if MMR vaccination rates increase with lower provisional periods, fewer exemptions, and lower exemption accessibility. The coefficients also support a direct relationship between MMR rates and higher levels of enforcement.

Local studies may be more effective in measuring enforcement variables. Language from state policies may not be reflective of actual enforcement measures. De facto procedures used in enforcing mandatory youth vaccinations may differ significantly from the language in state policies due to institutional norms, leadership, and individual behavior. Previous studies that found a relationship between vaccination rates and enforcement used survey data from school administrators. Regardless of the statistical data, media reports demonstrate that there is shared concern among states that schools are not reporting accurate immunization data or adequately enforcing existing policies, which could undermine efforts to improve vaccination rates. Although the findings are not statistically significant, the modeling of exemption and

enforcement variables provides a useful national framework for understanding mandatory immunization policies.

5.1 POLICY IMPLICATIONS

A national overview of mandatory youth immunization policies reveals significant variation in states' exemption and enforcement policies. As state legislatures and agencies analyze their own immunization policies, other state frameworks may be helpful in finding solutions to improve youth vaccination rates. Media reports discussed above suggest that enforcement policies do impact vaccination rates, although evidence points to a stronger relationship between exemption policies, such as the types of exemptions permitted and the accessibility of non-medical exemptions, and vaccination rates, enforcement policies should still be considered in efforts to increase vaccination rates. Several policy considerations can be drawn from this report:

- When reviewing policies to improve youth immunization rates, enforcement variables should not be overlooked. Local studies have found that school officials' level of enforcement can impact vaccination rates and enforcement is a key component collecting and reporting accurate data.
- Greater emphasis is needed on collecting and reporting accurate youth immunization data. Media reports have demonstrated that immunization data collection is often flawed. Unreliable data not only undermine attempts to study variables related to youth vaccination rates, but also puts students' safety at risk. Officials must be able to quickly identify un- or under-vaccinated students in the event of an outbreak.

- State officials must provide adequate training and oversight to ensure school compliance. While student safety is a responsibility for schools, administrators may need assistance from public health agencies to effectively work with non-compliant students for best outcomes. Health officials have more authority in advising the public on matters of public health, and they can serve as a third party when working with guardians to understand their options for vaccinations and the importance of immunization.
- State health officials should regularly communicate with administrators the importance of their work and provide education on enforcement procedures and best practices. Given the importance of immunization rates in protecting the health and safety of youth, oversight and auditing should be implemented to ensure these systems work effectively.

6.0 SUMMARY

Although a state-level analysis of exemption and enforcement variables does not show a statistically significant relationship between these variables and MMR vaccination rates, there are several limitations associated with these data. Local-level analyses using surveys and interviews with school administrators do indicate a stronger relationship between enforcement and vaccination rates. However, because there does not appear to be any single variable that greatly impacts vaccination rates, more research and state-level analysis are needed to understand the how policy changes may impact vaccination rates. State officials should prioritize working closely with school administrators to collect accurate data that are essential for informing policy amendments. Policy alone is not a panacea to increase vaccination rates among youth and must be supported by education and enforcement measures.

APPENDIX A: MMR VACCINATION RATES FOR THE 2014-2015 SCHOOL YEAR

State	Total Kindergarten Population	% Surveyed	Survey Type	MMR
HP 2020 Target				95.0
U.S. Median				94.0
Alabama*	59,660	100.0	Census	≥93.5
Alaska [†]	10,129	7.8	Stratified 2-stage cluster sample	92.7
Arizona	86,153	98.3	Census	94.2
Arkansas [‡]	41,252	95.9	Census (public), Voluntary response (private)	88.4
California [‡]	552,583	96.9	Census	92.6
Colorado	70,597	0.5	Simple random sample	86.9
Connecticut*	39,948	100.0	Census	97.0
Delaware	11,476	7.9	Stratified 2-stage cluster sample	97.8
District of Columbia*	7,840	100.0	Census	90.4
Florida* [§]	228,982	100.0	Census	≥93.3
Georgia*	139,471	100.0	Census	≥94.0
Hawaii	20,085	5.6	Stratified 2-stage cluster sample	NA
Idaho*	22,968	100.0	Census	89.5
Illinois*	156,942	100.0	Census	94.7
Indiana	85,477	70.1	Voluntary response	89.3
Iowa	43,239	96.3	Census	≥91.9
Kansas ^{†,‡}	39,685	24.5	Stratified 2-stage cluster sample	89.2
Kentucky [‡]	57,884	97.2	Census	92.7
Louisiana*	60,377	100.0	Census	96.8
Maine [‡]	13,704	88.9	Voluntary response (public), Census (private)	92.1
Maryland [‡]	75,391	90.2	Census (public), Voluntary response (private)	99.1
Massachusetts* ^{§,‡}	74,869	100.0	Census	94.7
Michigan*	117,963	100.0	Census	94.3
Minnesota	70,896	97.8	Census	93.5
Mississippi*	44,129	100.0	Census	≥99.2
Missouri*	75,900	100.0	Census	95.8

State	Total Kindergarten Population	% Surveyed	Survey Type	MMR
HP 2020 Target				95.0
U.S. Median				94.0
Nebraska*. [‡]	26,665	100.0	Census	96.0
Nevada	36,755	2.8	Stratified 2-stage cluster sample	94.0
New Hampshire	12,422	98.9	Census (public), Voluntary response (private)	≥91.4
New Jersey [‡]	120,471	93.9	Census (public), Voluntary response (private)	≥92.3
New Mexico [‡]	29,918	3.3	Stratified 2-stage cluster sample	97.7
New York State*. [‡]	237,045	100.0	Census	98.2
North Carolina	129,792	95.0	Census (public), Voluntary response (private)	98.5
North Dakota	10,017	99.9	Census	89.8
Ohio	149,080	91.0	Census (public), Voluntary response (private)	91.9
Oklahoma [‡]	56,967	95.9	Census	90.3
Oregon*. [‡]	46,229	100.0	Census	94.1
Pennsylvania [‡]	146,378	98.3	Census	91.7
Rhode Island [‡]	11,163	98.9	Census	95.7
South Carolina	62,864	12.2	Stratified 1-stage cluster sample	96.5
South Dakota*	12,008	100.0	Census	97.1
Tennessee*	78,276	100.0	Census	≥95.1
Texas [‡]	406,099	98.3	Census (public), Voluntary response (private)	97.4
Utah*	50,916	100.0	Census	94.0
Vermont*	6,277	100.0	Census	92.7
Virginia	103,821	4.1	Stratified 2-stage cluster sample	93.4
Washington	88,809	96.7	Census (public), Voluntary response (private)	89.4
West Virginia	22,016	81.3	Voluntary response	97.6
Wisconsin [‡]	69,335	2.5	Stratified 2-stage cluster sample	91.6
Wyoming [¶]	7,983	97.9	Census	96.8

APPENDIX B: REGRESSION OUTPUT

Source	SS	df	MS	Number of obs	=	35
Model	18.8340422	4	4.70851054	F(4, 30)	=	0.54
Residual	259.972815	30	8.6657605	Prob > F	=	0.7051
Total	278.806857	34	8.20020168	R-squared	=	0.0676
				Adj R-squared	=	-0.0568
				Root MSE	=	2.9438

mmr_n	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
pa_months_n	-.0149143	.0548487	-0.27	0.788	-.1269303	.0971018
no_ex	-1.494864	1.161586	-1.29	0.208	-3.867138	.8774108
access_ex_n	-.0583754	.8077899	-0.07	0.943	-1.708103	1.591352
enforcement~l	.4391411	1.197108	0.37	0.716	-2.005679	2.883962
_cons	96.57243	4.316731	22.37	0.000	87.75649	105.3884

Variables:

mmr_n- each state's MMR vaccination rate for the 2014-2015 school year

pa_months_n- the length of the provisional period*

no_ex- the number of exemptions each state allows for

access_ex_n- the state's accessibility model (1=low accessibility, 2=moderate, 3=high)

enforcement~l- the state's enforcement model (1=low enforcement, 2=moderate, 3=high)

* For the provisional admittance variable, states with a provisional period of a "minimal acceptable timeframe" were categorized as 24 months for the regression analysis

BIBLIOGRAPHY

- Achievements in Public Health, 1900-1999 Impact of Vaccines Universally Recommended for Children -- United States, 1990-1998. (1999, April 2). Centers for Disease Control. *MMWR*. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/00056803.htm>
- Ahearn, W. H. (2010). What Every Behavior Analyst Should Know About the “MMR Causes Autism” Hypothesis. *Behavior Analysis in Practice*, 3(1), 46–50.
- Anthony, N., Reed, M., Leff, A. M., Huffer, J., and Stephens, B. (1977). Immunization: public health programming through law enforcement. *American Journal of Public Health*, 67(8), 763–764.
- Casey, Tony. (2015, November 16). Are your kids immunized? Johnson City Schools conducting audit after inquiries. *Johnson City Press*. Retrieved from <http://www.johnsoncitypress.com/Health-Care/2015/11/16/Johnson-City-Schools-conducting-vaccination-audit.html?ci=stream&lp=1&p=15.5384615384615>
- Colorado’s Personal Belief Exemption Policy for Immunizations: Stakeholder Engagement Process. (2013). The Keystone Center. Retrieved from https://www.colorado.gov/pacific/sites/default/files/PW_Imm_Personal-Belief-Exemption-Stakeholder-Engagement-Report.pdf
- Fogarty, K. J., Massoudi, M. S., Gallo, W., Averhoff, F. M., Yusuf, H., & Fishbein, D. (2004). Vaccine coverage levels after implementation of a middle school vaccination requirement, Florida, 1997-2000. *Public Health Reports*, 119(2), 163–169.
- Goldberg, Dan and Nidhi Prakash. (2015, January 20). At some city private schools, immunization rates stay low. *Politico New York*. Retrieved from <http://www.capitalnewyork.com/article/albany/2015/01/8559284/some-city-private-schools-immunization-rates-stay-low>
- How is your school doing? (2015). California Department of Public Health, Immunization Branch. Retrieve from <http://www.shotsforschool.org/k-12/how-doing/>
- The HPV Vaccine: Access and Use in the U.S.. (2015, September 3). Kaiser Family Foundation. Retrieved from <http://kff.org/womens-health-policy/fact-sheet/the-hpv-vaccine-access-and-use-in/>

- Immunization and Infectious Diseases. (2016). Office of Disease Prevention and Health Promotion. *Healthy People 2020*. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives>
- Lattanzio, Vince. (2015, April 9). Immunizations Unknown: Pa. School Vaccine System Flawed. *NBC 10 Philadelphia*. Retrieved from <http://www.nbcphiladelphia.com/news/health/Immunizations-Unknown-Flawed-Pennsylvania-PA-Vaccines-299240301.html>
- Lillvis, D. F., Kirkland, A., & Frick, A. (2014). Power and Persuasion in the Vaccine Debates: An Analysis of Political Efforts and Outcomes in the United States, 1998-2012. *The Milbank Quarterly*, 92(3), 475–508.
- Measles Cases and Outbreaks. (2016, January 12). Centers for Disease Control. Retrieved from <http://www.cdc.gov/measles/cases-outbreaks.html>
- Mello MM, Studdert DM, Parmet WE. Shifting Vaccination Politics--The End of Personal-Belief Exemptions in California. (2015). *New England Journal of Medicine*. 373(9): 785-7.
- Middaugh JP, Zyla LD. Enforcement of school immunization law in Alaska. (1978). *Journal of the American Medical Association*, 239(20): 2128-30.
- Orenstein WA, Hinman AR. (1999). The immunization system in the United States - the role of school immunization laws. *Vaccine*. 17 Supplement 3: S19-24.
- Robbins, K. B., Brandling-Bennett, D., & Hinman, A. R. (1981). Low measles incidence: association with enforcement of school immunization laws. *American Journal of Public Health*. 71(3), 270–274.
- Rota, J. S., Salmon, D. A., Rodewald, L. E., Chen, R. T., Hibbs, B. F., & Gangarosa, E. J. (2001). Processes for obtaining nonmedical exemptions to state immunization laws. *American Journal of Public Health*. 91(4), 645–648.
- Salmon, D. A., Omer, S. B., Moulton, L. H., Stokley, S., deHart, M. P., Lett, S., ... Halsey, N. A. (2005). Exemptions to School Immunization Requirements: The Role of School-Level Requirements, Policies, and Procedures. *American Journal of Public Health*, 95(3), 436–440.
- Sample Enforcement Letter for School Auditing. (2015). New Jersey Department of Health. Retrieved from http://www.nj.gov/health/cd/documents/sample_enforcement_letter_auditing.pdf
- School Immunization Rate. (2014). Pennsylvania Department of Health. Retrieved from <http://www.health.pa.gov/My%20Health/Immunizations/schoolimmunizationrates/Pages/default.aspx#.Vqe78DaleRs>

- SchoolVaxView: 2009-10 through 2014-15 School Year Vaccination Coverage Trend Report. (2015). Retrieved from <http://www.cdc.gov/vaccines/imz-managers/coverage/schoolvaxview/data-reports/coverage-trend/2014-15.html>
- Schum, T. R., Nelson, D. B., Duma, M. A., & Sedmak, G. V. (1990). Increasing rubella seronegativity despite a compulsory school law. *American Journal of Public Health*, 80(1), 66–69.
- State exemption levels low, national vaccination rates high. (2015). *Centers for Disease Control Newsroom Releases*. Retrieved from <http://www.cdc.gov/media/releases/2015/p0827-vaccination-rates.html>
- Summary of Recommendations for Child/Teen Immunization. (2015, September). Immunization Action Coalition. Retrieved from <http://www.immunize.org/catg.d/p2010.pdf>
- Survey: One third of American parents mistakenly link vaccines to autism. (2014, April 2). National Consumers League. Retrieved from http://www.nclnet.org/survey_one_third_of_american_parents_mistakenly_link_vaccines_to_autism
- Wahlberg, David. (2012, January 12). Number of families seeking vaccine exemptions rises in Wisconsin. *Wisconsin State Journal*. Retrieved from http://host.madison.com/wsj/news/local/health_med_fit/number-of-families-seeking-vaccine-exemptions-rises-in-wisconsin/article_35655b18-3732-11e1-9fb5-001871e3ce6c.html
- Walkinshaw, E. (2011). Mandatory vaccinations: The international landscape. *CMAJ: Canadian Medical Association Journal*, 183(16), e1167–e1168.
- Wheeler, M., & Buttenheim, A. M. (2014). Ready or not? School preparedness for California's new personal beliefs exemption law. *Vaccine*, 32(22), 2563–2569.