

Vaccine Coverage Levels after Implementation of a Middle School Vaccination Requirement, Florida, 1997–2000

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SYNOPSIS

Objective. Little information is available about the effectiveness of school entry vaccination requirements at the middle school level. This study examined coverage levels among students entering seventh grade in Florida following implementation of a school entry vaccination requirement in 1997.

Methods. The authors analyzed county-specific vaccination coverage levels (three doses of hepatitis B vaccine, a second dose of measles, mumps, and rubella [MMR] vaccine, and a booster dose of tetanus and diphtheria toxoids [Td]) among students entering public and private schools in Florida from 1997 through 2000. In 1998, a survey of all county health departments was conducted, and the resulting data were linked to county-specific vaccination rates.

Results. During the 1997–1998 school year, the first year the requirement went into effect, at school entry 121,219 seventh-grade students (61.8%) were fully vaccinated, 72,275 seventh grade students (36.9%) lacked one or more doses of vaccine but were considered in process, 1,817 were non-compliant (0.9%), and 763 had medical or religious exemptions (0.4%). In the 2000–2001 school year, the proportions of students reported fully vaccinated at school entry had increased to 66%. Most of this change was related to an increase in hepatitis B coverage. There was a significant inverse relationship between the proportion of students fully vaccinated and the size of the county's seventh grade population.

Conclusions. The seventh grade vaccination entry requirement was associated with sustained high levels of vaccination coverage. Passing a school entry vaccination requirement appears may be sufficient to increase coverage, but other strategies may be required to achieve full immunization of middle school students.

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Although the United States has recently achieved near universal infant vaccination, many adolescents did not receive recommended vaccines as infants because these vaccines were either not recommended or not required at the time. For example, although the Advisory Committee on Immunization Practices (ACIP) recommended universal vaccination of infants with hepatitis B vaccine in 1991, coverage among infants did not reach 90% until 2000, according to the National Immunization Program, Centers for Disease Control and Prevention (CDC). Therefore, adolescents continue to enter adulthood at risk for vaccine-preventable morbidity and mortality. In 1996, the ACIP, the American Academy of Pediatrics, the American Academy of Family Physicians, and the American Medical Association published joint recommendations that called for adolescents to visit their health care providers at age 11 or 12 years to receive a number of preventive services, including vaccination with hepatitis B vaccine; a second dose of measles, mumps, and rubella (MMR) vaccine; varicella vaccine (if indicated); a booster dose of tetanus and diphtheria toxoids (Td); as well as other vaccines that may be indicated for certain adolescents.¹ Despite this recommendation and the success of small voluntary vaccination programs, the coverage level for hepatitis B in 1997 was only 15% among adolescents.^{2,3}

The implementation and enforcement of school entry requirements is an effective mechanism for decreasing vaccine-preventable diseases and assuring high vaccination coverage in children entering primary school⁴ and young adults entering college.⁵ In 1997, the state of Florida implemented middle school requirements that students entering the seventh grade have documentation of receipt of three doses of hepatitis B vaccine, a second dose of MMR vaccine, and a Td booster. This new vaccination recommendation was incorporated through an amendment to the Florida Administrative Code (64D-3.001, F.A.C.) in July 1996, which was then implemented in 1997.

Little is known about the effectiveness of entry requirements for adolescents entering middle school. Aside from preliminary reports of experiences in the states of Florida and California,^{6,7} which indicated that school vaccination laws could result in substantial increases in hepatitis B vaccine coverage, there have been no published evaluations of middle school vaccination requirements in the United States. The present report describes statewide and county-specific vaccination coverage levels among students entering seventh grade in Florida each year from 1997, when the new requirement was implemented, through 2000. We also

examined in detail the implementation of the requirement among seventh graders entering public and private school in each of the 67 counties of Florida in 1997.

METHODS

Study population and design

The study was conducted by the Florida Department of Health, Bureau of Immunization, in collaboration with the CDC. Effective with the 1997–1998 school year, children entering the seventh grade in Florida schools were required to produce a Certificate of Immunization (or Certificate of Exemption) documenting vaccination against hepatitis B, a second dose of MMR vaccine, and a Td booster prior to school admission or attendance. To ensure compliance with this new requirement, each October all public and private schools with a seventh grade are required to submit reports to the county health department indicating the vaccination status of kindergarten and seventh grade students. These certificates, signed by health care providers, indicating the number of doses of hepatitis B vaccine, MMR vaccine, and Td booster received by each student, are kept by the middle school. Schools send summary reports to the county health department, where these data are compiled and then sent to the Bureau of Immunization, State of Florida, in Tallahassee. Information for the summary reports is obtained by the schools from students' vaccination certificates. This information is used to determine vaccination coverage levels among seventh graders as of October of each school year.

Variables and outcomes of interest

Students were considered:

- *Fully vaccinated* if they had received three doses of hepatitis B vaccine, a second dose of MMR, and a Td booster.
- *In process* if they lacked one or more required vaccinations but were on schedule and had received at least one dose of hepatitis B vaccine or a second dose of MMR or a Td booster.

In June 1998, we conducted a survey of all county health departments. The survey was pilot-tested in one county (data not included in the results reported below). We collected information about county characteristics, compliance strategies implemented, and vaccination activities conducted. We also examined health department records regarding doses of vaccine administered during 1993–2000 in public clinics to

determine the burden of vaccination on the county health departments before and after the implementation of the law.

Statistical analyses

We linked the survey data to county-specific vaccination coverage levels and data on doses administered. The association between selected county characteristics and the percent of students entering seventh grade fully vaccinated was determined by univariate analysis using the Pearson correlation coefficient. Factors at least marginally associated ($p < 0.15$) with vaccination level were entered into a stepwise linear regression analysis to identify factors independently associated with coverage. All analyses were carried out using SAS Version 6.12.⁸

RESULTS

At the start of the 1997–1998 school year, 196,074 students entered the seventh grade in Florida. In October 1997, the first year the requirement went into effect, 121,219 (61.8%) seventh-grade students were fully vaccinated, 72,275 (36.9%) lacked one or more doses of vaccine but were considered in process, 1,817 (0.9%) were non-compliant, and 763 (0.4%) had medical or religious exemptions.

The percentage of seventh-grade students who were reported to be fully vaccinated at school entry increased slightly each subsequent year, from 62% in October 1997 to 66% in October 2000, while the percentage of students reported in-process decreased slightly each subsequent year, from 37% in October 1997 to 32% in October 2000 (Figure 1). Coverage with each individual vaccine remained similar in October of each school year, except for the third dose of hepatitis B vaccine, which increased from 74.3% in 1997 to 80.8% in 2000 (Table 1).

From 1995 to 1997, the number of vaccinations administered to children 10 to 14 years of age by Florida public health facilities (i.e., school-based, county, or city clinics) increased markedly (Figure 2). The largest increase was observed for hepatitis B vaccine (260%). Following implementation of the requirement in 1997, the number of doses of hepatitis B vaccine administered to children ages 10–14 years by the Florida Department of Health remained stable in 1998–1999.

In the 1997–1998 school year, the median county-specific coverage (fully vaccinated) was 72.1%; the 25th percentile of students fully vaccinated was 58.9% and the 75th percentile was 81.9%. Vaccination coverage of seventh graders at the beginning of the 1997–1998 school year varied widely among the 67 Florida

Figure 1. Vaccination status of seventh graders, Florida, October 1997–October 2000

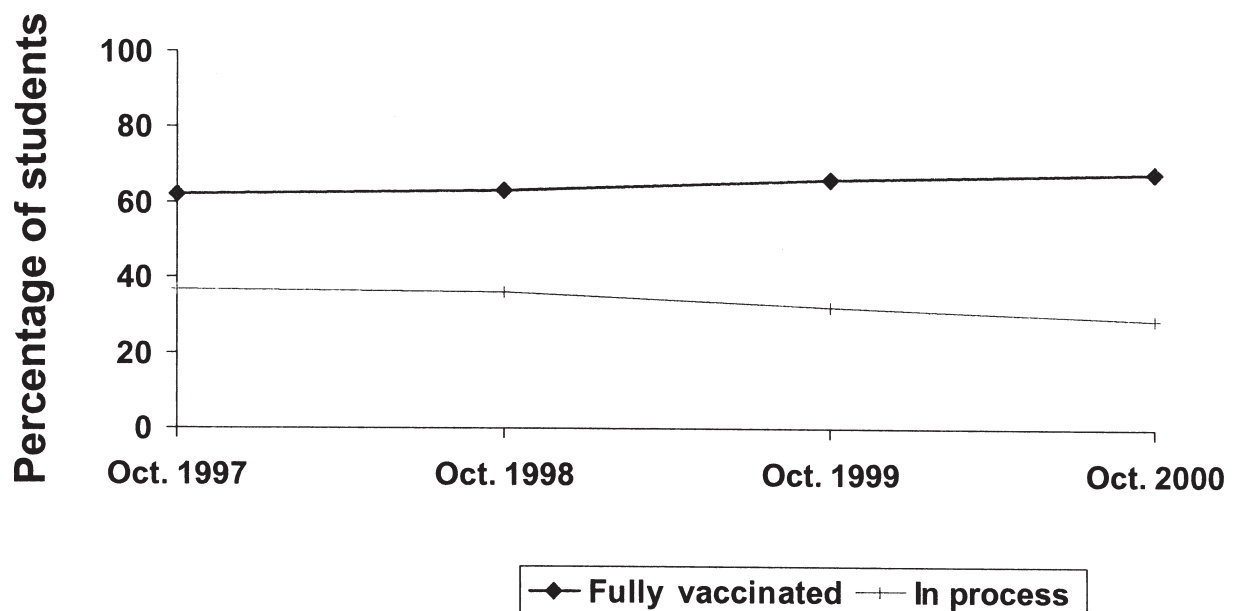


Table 1. Vaccination coverage among second graders by type of vaccine, Florida, October 1997–October 2000

Vaccine	October 1997	October 1998	October 1999	October 2000
Hepatitis B				
First dose	96.0%	98.4%	97.5%	98.3%
Second dose	92.7%	96.1%	95.2%	96.7%
Third dose	74.3%	77.6%	77.1%	80.8%
MMR (second dose)	98.1%	98.4%	97.9%	99.0%
Td booster	96.1%	97.3%	96.3%	97.1%

counties, ranging from 36.0% to 97.2% (Figure 3), and in the six counties with >10,000 seventh graders (range 43.1% to 77.9%; $p < 0.0001$). The median county-specific coverage slightly decreased from the 1997–1998 school year to the 1999–2000 school year; in 1999–2000, the median was 70.1%, the 25th percentile of students fully vaccinated was 62.7%, and the 75th percentile was 82.1% (Figure 3).

Association of coverage and county characteristics

Fifty-nine counties (89%) responded to our survey. When we compared the 59 counties to the seven counties that did not respond, we found no significant differences ($p \geq 0.05$) in median seventh grade population, the percentage of students enrolled in private

schools, and the percentage of students fully vaccinated (data not shown).

Univariate analysis indicated that the size of the seventh grade population and the percentage of students in public schools were negatively correlated with the percentage of students fully vaccinated (Table 2). The size of the seventh grade population was the only variable independently associated with students being fully vaccinated. Coverage was not related to school-based vaccination, health department education efforts, offering of vaccinations, enforcement (i.e., prohibiting students from attending school), or total dollars expended per student.

Statewide, coverage among the 177,903 Florida seventh graders enrolled in 617 public schools was sig-

Figure 2. Vaccines administered by the Florida Department of Health to children ages 10–14 years, by fiscal year, Florida 1993–1999

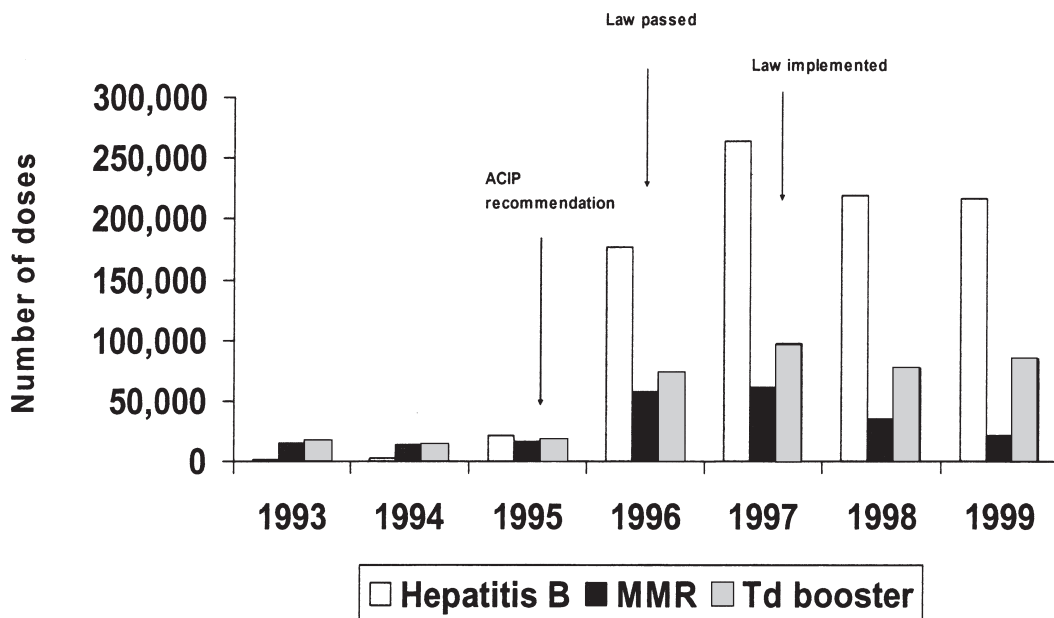
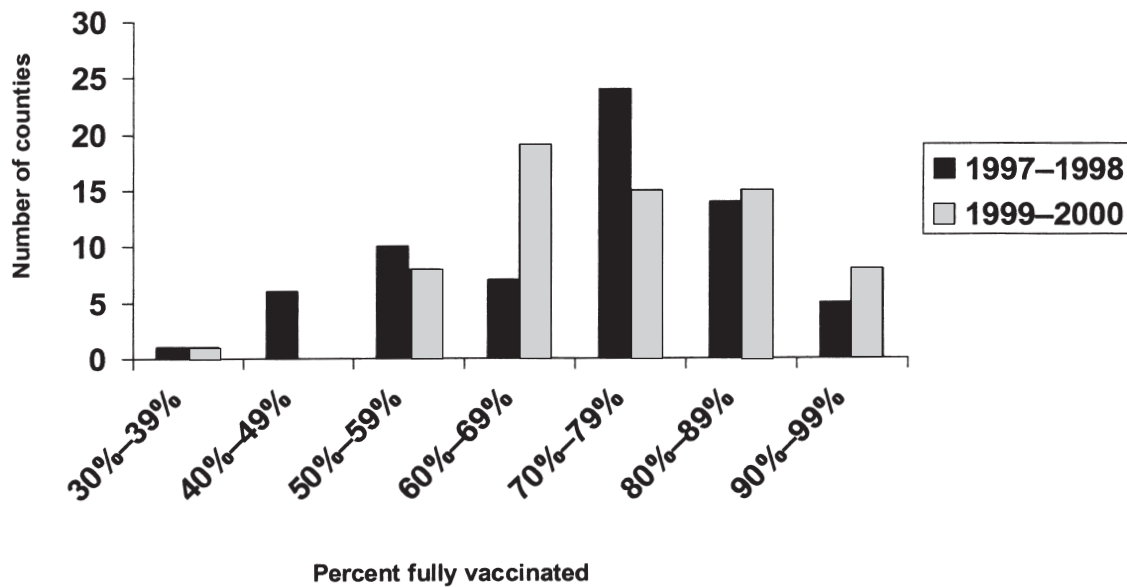


Figure 3. Percentage of seventh grade students who were fully vaccinated, by number of counties, Florida 1997–2000



nificantly lower (59.6%) than among the 18,171 seventh graders enrolled in 669 private schools (83.8%) ($p < 0.0001$). In larger counties ($\geq 25,000$ population), a higher proportion of private school students than of public school students were fully vaccinated.

DISCUSSION

The National Immunization Program estimates that each year more than 3.5 million adolescents enter

adulthood without having received recommended vaccines. Identification of effective strategies to achieve and maintain high vaccination coverage levels is important to prevent vaccine-preventable diseases in these individuals. The previous successes of school entry requirements among younger children suggest the potential of such strategies.⁴ This study found that in the first year of implementation (the 1997–1998 school year), the middle school vaccination entry requirement in Florida was effective in ensuring that almost

Table 2. Association between selected county characteristics and percentage of entering seventh-grade students fully vaccinated, Florida, 1997–1998 (N=67 counties)

County-level variable	Number of counties responding	Pearson's R	p-value
Seventh grade population	66	-0.49	0.0001
Percent of students in private schools	66	-0.34	0.006
Percent of schools offering vaccine	50	0.23	0.11
Health department efforts			
Education campaign	59	-0.17	0.20
Offering vaccinations in schools	59	0.04	0.79
Enforcement	59	-0.01	0.91
Increase in doses of hepatitis B vaccine administered by public health department, 1996 to 1997	65	0.03	0.81
Total dollars expended per student	32	-0.03	0.86

NOTE: Fully vaccinated is defined as having received three doses of hepatitis B vaccine, a second dose of MMR, and a Td booster.

all (98.7%) seventh grade students were either fully vaccinated or in the process of completing the required vaccinations. This high level of compliance was sustained among seventh graders in subsequent school years, possibly indicating greater understanding of and compliance with the requirements.

Although high vaccination coverage levels were achieved for seventh graders, the coverage levels varied widely among counties and between private and public schools. Data showing that the median county level of vaccine coverage was approximately the same in 1997 and 2000 but that the gap between 25th and 75th percentiles narrowed slightly by year 2000 indicate a decrease over time in this variation. Others have also found that vaccine coverage is higher in private schools than in public schools following the implementation of requirements, but whether this is related to better enforcement or higher socioeconomic status is unknown.⁹

Various methods were used to encourage students to receive the recommended vaccines prior to the start of the 1997–1998 academic year. Schools and county health departments worked with the media, sent notices out with report cards and utility bills, and enlisted the aid of businesses and community groups. Some schools included vaccination as a subject in their health education curricula.

However, our findings indicate that the extent to which selected strategies were used was not associated with county coverage levels. Only the size of the seventh grade population was independently associated with coverage levels. While we do not know why size of population was associated with coverage, we can speculate that dissemination of information about the law and community vaccination efforts were more effective in smaller counties than larger ones. The lack of association of enforcement of the school law with coverage was surprising; however, this may have been due to limitations of the survey and our inability to collect more detailed information on the degree of enforcement of the law.

The strongest limitation of this study was that we lacked information regarding vaccination coverage levels among seventh graders before implementation of the middle school law and therefore were unable to measure the actual impact of the requirement. However, available information indicates that the hepatitis B vaccine (three or more doses) coverage level among adolescents nationally in 1997 was only 15% (Unpublished data, National Immunization Program). There is no reason to suspect that the coverage level among adolescents in Florida was much higher than the national average prior to the implementation of the

Florida requirement. The substantial increase in the number of doses administered by county health departments to 10- to 14-year-olds in 1997, and the subsequent decreases in 1998 and 1999 suggest that adolescents initially received vaccinations in public clinics but later received vaccinations in the private sector. We did not collect information on whether there was a corresponding decrease in private sector doses administered. The findings that public sector vaccine doses administered to adolescents substantially increased after publication of the ACIP recommendations for adolescent vaccination (in 1996) and again after implementation of the Florida middle school entry requirements suggest that both of these factors may have contributed to the achievement of high vaccination coverage levels among seventh graders.

Other limitations of the study include the following: (1) We did not independently verify the reliability of the administrative data given to us by the Florida Department of Health. (2) The county vaccine coverage in previous years is unknown. (3) The number of vaccinations received by adolescents from their primary care providers or managed-care organization is unknown.

In spite of the effectiveness of the law, follow-up still remains a challenge. In the 2000–2001 school year, approximately one-quarter (25.7%) of students coming into the seventh grade had not completed the hepatitis B series. The administrative burden for schools to track and follow up with students entering seventh grade who are in-process but not fully immunized still remains high, although in the four years of implementation the proportion requiring follow-up fell from 36.9% (more than 72,000 children) to 29.1% (more than 60,000 children). At least one county reported a substantially increased administrative burden following a more lenient policy of allowing children in school who were not complete or current on their vaccinations. They reported that this resulted in a large number of inadequately immunized children who required additional follow-up after the beginning of the school year.

CONCLUSION

Nationally, many adolescents continue to be at risk of infection because they lack adequate vaccination coverage. Middle school vaccination requirements appear effective in achieving and sustaining high vaccination coverage among adolescents. States with middle school requirements should give special attention to implementation efforts in the most populous counties and focus implementation efforts on public schools.¹⁰ Ef-

forts to increase vaccination coverage in adolescents could focus on educating and reminding parents and providers and developing school-based programs and regulations. Although school-based vaccination programs have been previously shown to be effective,¹¹ further study is needed to understand the role of school-based vaccination in the implementation of school entry requirements for adolescents.

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