IMMUNIZATION PROGRAM PRACTICES INFORMATION

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Yes No

BULL’S-EYE AWARD

Would you like for this submission to be considered for the 2018 AIM Bull’s-Eye Award?

Yes No

PROGRAM PRACTICE INFORMATION

Title
School Immunization Quality Improvement in North Dakota

Keywords (up to 5 main terms/phrases that describe the practice)
School immunization requirements, exemptions, enforcement, quality improvement

Is this practice Evidence / Guideline Based? (if yes, please include reference below) 

Yes No

Reference:
Community Guide - school immunization requirements

Background (scope of the immunization need or problem)
To better understand North Dakota’s decreasing immunization rates, increasing exemption rates, and the large number of students with an unknown immunization status, the North Dakota Department of Health (NDDoH) implemented quality improvement to increase rates at school entry. The NDDoH partnered with key stakeholders to identify areas of improvement. The NDDoH engaged the North Dakota State University (NDSU) Center for Immunization Research and Education (CIRE) to study immunization policies and practices in the state. The CIRE was tasked with surveying immunization stakeholders about their beliefs regarding school and child care immunizations and exemptions in North Dakota. The CIRE was also tasked with researching other states’ school and child care immunization enforcement and exemption laws and policies.

Program Practice Description
Describe the practice goals and objectives.
1) To gain an understanding of the current state of immunization and exemption attitudes and opinions in North Dakota,
2) To facilitate meaningful participation in in-depth discussions on current immunization and exemption policies and practices in North Dakota, and
3) To make recommendations for potential policy, rule, or practice/process changes to the current immunization and exemption system in North Dakota.

**What were the main implementation activities?**

- ND Attorney General’s office education about enforcement to school administrators.
- NDSU CIRE focus groups, research of other state practices, and final report on opportunities for improvement.
- North Dakota Administrative Rules stated that the tetanus, diphtheria, and acellular pertussis (Tdap) booster and meningococcal conjugate (MCV4) vaccines were required for seventh grade entry. The rules were changed to include the next higher grade each subsequent year to ensure that students who were not vaccinated at seventh grade or who are transferring to a North Dakota school are included in the requirement.
- The NDDPI, working closely with the NDDoH, encouraged and educated about enforcement of school immunization requirements.
- The NDDoH and the NDDPI modified the state immunization manual. The updated manual includes sample documents, current requirements, best practices, and frequently asked questions. It is distributed and/or promoted among schools and local public health units.
- The NDDoH provides more guidance to schools on the management of immunization compliance and exclusion for homeschooled children.
- In the school immunization survey, homeschool data is collected separately.
- The NDDPI includes immunization training opportunities for school administrators and staff to learn how to best incorporate immunization policies and practices into their schools.
- The NDDPI and NDDoH encourage all schools to track immunization status and compliance through the use of an electronic system. A school module has been developed for the NDIIS.
- Schools work closely with local public health units to improve immunization rates and compliance.
- Some schools host immunization clinics to achieve high immunization rates and full immunization compliance.

**Where and when did the practice take place?**

North Dakota, July 2015 – August 2016. NDDoH continues to implement recommendations from the final report.

**How much staff time was involved?**

.20 FTE at the NDDoH, 1.5 FT at NDSU CIRE

**What were the costs associated with the activity? What was the funding source?**

$91,935, CDC immunization cooperative agreement (317 and PPHF), .2 FTE at NDDoH

**Identify the target population that the practice affected.**

North Dakota students, North Dakota schools

**If partners were involved, include who was involved, and how.**

- NDSU Center for Immunization Research and Education – Dr. Paul Carson, Kylie Hall, Danielle Pinnick, Nathan Fix, Rick Jansen, Abby Gold
- Local public health units
Timeframe of Implementation (Start and Stop Dates)
01/21/2015 - Continuing

Evaluation Data: Was the implementation and/or effectiveness of this practice assessed? (if “yes” or “limited,” provide any data that is available) __X_Yes ___No ___Limited

Data: ND kindergarten entry immunization rates increased from 91% during the 2015 - 2016 school year to 94% during the 2016 - 2017 school year.

Conclusions / Lessons Learned / Key Factors for Success
Overall, school enforcement of immunization requirements has the greatest potential to increase immunization rates in North Dakota. With 7% of students unaccounted for in kindergarten immunization data, bringing those students up-to-date with requirements or collecting records for those students could increase immunization rates above 95% in many areas of the state, as seen in two large school districts that began enforcing immunization requirements during the 2015-2016 school year. Even if the exemption process is made more difficult, decreasing the current immunization exemption rate of 3% will have much less impact on immunization rates compared to stricter school enforcement of immunization requirements. Other practice and policy changes were recommended and are included in the final report from the NDSU CIRE:

Journal article: https://www.ncbi.nlm.nih.gov/pubmed/29153127

The NDDoH has implemented a number of the NDSU CIRE’s recommendations and continues to do so. Kindergarten immunization rates increased from 91% to 94% in the past year.

Recent news release about ND kindergarten rates: https://health.nd.gov/media/1657/2017-02-27-nd-school-immunizationr_final.pdf

ND School Immunization website: http://www.ndhealth.gov/Immunize/Schools-ChildCare/

Check if any of the following are being submitted to complement your submission:
(All materials will be posted on the AIM website) __Testimonials
__Quote from partner/participant
__Sample of materials produced
__Press release
__Promotional materials
__Project photo(s)
__Publication (e.g., news story, journal article)
__Video/audio clip
__Website URL
__Tables or graphs
__Other — Explain: ND School Immunization Story Board
We were not able to check the effectiveness of our intervention, as funding was not approved to implement the school module. Immunization rates remained the same for the 2014-2015 school year, so there was no improvement.

During the 2015 Legislative Session, the North Dakota Department of Health included the NDIIS school module as part of the 2015-2017 budget request. The school module would link the NDIIS with each school system to allow schools to run reports and assess the immunization coverage of each school. The immunization program would be able to receive immunization coverage reports for each school by grade. This would fulfill the need for a school assessment, allow schools to properly ascertain their coverage rates, reduce time spent by schools to review paper records, reduce duplicate data entry by schools and provide more accurate information on coverage at a given point in time. The legislators voted not to approve funding for the NDIIS school module.

**AIM STATEMENT:** Increase school entry immunization rates for North Dakota children to 95% (Healthy People 2020 Goal) by December 31, 2018.

**BACKGROUND**

North Dakota school entry immunization rates are below the Healthy People 2020 goal of 95%. 95% immunization rates are needed to ensure herd immunity and prevention of disease in the school and community. In addition, philosophical exemption rates in North Dakota are increasing. Schools currently use a paper process to determine compliance with immunization laws, even though the NDIIS is available and contains most children's immunization records.

**PLAN**

1. **Assemble the Team:** The QI team members were assembled from members of the North Dakota Department of Public Instruction, the North Dakota Department of Health, Local Public Health Units, Local Schools, the Attorney General’s Office and Community stake holders. Members were selected for their knowledge of schools and immunizations. Project members included Molly Howell, Immunization Program Manager, NDDoH, Amy Schwartz, Immunization Surveillance Coordinator, NDDoH, Kirby Kruger, Disease Control Division Director, NDDoH, Tracy Miller, State Epidemiologist, NDDoH, Arvy Smith, Deputy State Health Officer, NDDoH, Dr. Terry Dwelle, State Health Officer, NDDoH, Valerie Fischer, Director of Safe & Healthy Schools, NDDPI, Kirsten Baesler, Superintendent of Public Instruction, NDDPI, Jerod Tufte, Counsel, ND Governor’s Office, and Representatives from Local Public Health Units, North Dakota Schools and the Attorney General’s office.

**IMPLEMENTATION**

During the 2015 Legislative Session, the North Dakota Department of Health included the NDIIS school module as part of the 2015 - 2017 budget request. The school module would link the NDIIS with each school system to allow schools to run reports and assess the immunization coverage of each school. The immunization program would be able to receive immunization coverage reports for each school by grade. This would fulfill the need for a school assessment, allow schools to properly ascertain their coverage rates, reduce time spent by schools to review paper records, reduce duplicate data entry by schools and provide more accurate information on coverage at a given point in time. The legislators voted not to approve funding for the NDIIS school module.

**CHECK**

Lessons Learned:
- Explore funding opportunities from other sources
- Need for linkage of the North Dakota Immunization System (NDIIS) to school systems
- Bringing stakeholders together allowed for other collaboration opportunities.

**ACT**

Future Plans:
- Continue to work to implement school module
- Identify other ways to increase school compliance with immunization requirements
Enforcement Associated With Higher School-Reported Immunization Rates

Kylie J. Hall, MPH,1 Molly A. Howell, MPH,2 Rick J. Jansen, PhD,1 Paul J. Carson, MD1

Introduction: North Dakota’s school-reported kindergarten immunization rates were among the lowest in the U.S. during the 2015–2016 school year. Ninety percent of kindergartners were fully immunized in accordance with state requirements, 3% had an exemption, and as many as 7% were noncompliant. School enforcement of immunization requirements has been noted as variable. This study sought to better understand the relationship between school-reported immunization rates and the enforcement of immunization requirements.

Methods: Kindergarten immunization rates were compared between schools annually enforcing immunization requirements to the point of excluding noncompliant children and schools not enforcing. In addition, immunization rates were assessed after an educational intervention that led some school districts to change their enforcement policies during the 2015–2016 school year. Analyses were completed in 2016 and 2017.

Results: Kindergarten immunization rates were significantly higher in schools that annually enforced compared with schools that did not enforce (p≤0.001, all vaccines; difference between means: diphtheria–tetanus–attenuated pertussis=7.5% [95% CI=3.9%, 11.1%]; polio=6.2% [95% CI=3.5%, 10.5%]; hepatitis B=3.7% [95% CI=1.5%, 5.9%]; and varicella=6.9% [95% CI=3.4%, 10.4%]). School districts that began enforcing saw a significant increase in vaccination rates (diphtheria–tetanus–attenuated pertussis=6% [95% CI=2%, 11%] and measles, mumps, and rubella=7% [95% CI=3%, 11%]). Enforcement in newly enforcing districts led to a large decrease in the number of noncompliant students and did not lead to significant increases in exemption rates.

Conclusions: In North Dakota, lack of school enforcement is strongly associated with lower immunization rates and a large noncompliant population. Addressing noncompliance through school enforcement could significantly increase school-reported immunization rates.


INTRODUCTION

North Dakota’s (ND) kindergarten immunization rates were among the lowest in the U.S. during the 2015–2016 school year. Only 90% of kindergartners were fully immunized against diphtheria, tetanus, and pertussis (DTaP); measles, mumps, rubella (MMR); and varicella, compared with the median, state-level immunization rate of 94% nationwide. During the same school year, 3.3% of ND kindergartners had an exemption to immunization.1 Nationally, the median, state-level exemption rate was 1.9% during this time period.1 According to the ND Department of Health (DoH) (personal communication, 2015), ND has seen a steady decline in immunization rates for more than a decade, as >95% of kindergartners were immunized against DTaP and MMR in 2000. ND has also experienced a sixfold
increase in the percentage of children with a personal belief exemption from 2000 to 2015, with only 0.5% of kindergartners having an exemption to immunization in 2000.

To better understand ND’s declining kindergarten immunization rates and increasing exemption rates, the NDDoH engaged the ND State University Center for Immunization Research and Education (CIRE) to study immunization policies and practices in the state. The CIRE learned that, despite the fact that enforcement of school immunization requirements is required by ND law, very few school districts enforce immunization requirements to the extent of excluding noncompliant children after 30 days. Enforcement is at the discretion of administrators in individual school districts, and there has been inconsistent guidance from statewide leadership regarding enforcement. This has resulted in variable immunization enforcement practices and a large number of students attending ND schools who are noncompliant with state immunization requirements. In ND, noncompliant students (1) are not up to date with school-required immunizations, (2) do not have an immunization record on file at their school, (3) are not immunized, and (4) do not have an exemption on file at their school.

The CIRE noted that as many as 7% of kindergartners may have been noncompliant with state immunization requirements during the 2015–2016 school year. Although much attention is often given to the growing number of parents filing for exemptions, the large noncompliant population is concerning because substantially more children in ND fall into this category than those who are exempt. This has also been found in other states.²

This analysis was conducted to better understand the relationship between school-reported immunization rates and the enforcement of immunization requirements in ND schools. The CIRE hypothesizes that schools enforcing state immunization requirements and excluding children noncompliant with such requirements would have higher immunization rates than schools not enforcing state immunization requirements.

### METHODS

#### Study Sample

To gather information about school immunization practices, the CIRE conducted focus groups and one-on-one interviews throughout the state with school administrators and staff between November 2015 and April 2016. To maximize study efforts to assess a large, representative sample of children across the state, a convenience sample of school districts in and adjacent to ND’s largest cities were asked to participate. Of 275 school districts in ND, 11 school districts, seven urban and four rural, were represented in seven focus groups and two interviews.

Participating school districts were asked to invite any school administrators and staff that assist with immunization policy or practice to participate in the focus groups. Overall, participation included nine school superintendents, 12 principals, 15 school nurses, and 19 school staff. All focus group participants and interviewees were asked the same set of questions regarding school immunization policies and practices (Table 1). Further information about the findings from the focus groups and interviews is available on the NDDoH’s website.³ This project was reviewed and approved by the IRB at ND State University, and all participants gave verbal consent to participate.

Because the project had participation from seven of the eight largest urban school districts, kindergarten immunization data from those seven school districts (total kindergartners=4,185), which enrolled >42% of ND’s kindergartners, was used to determine if there was a correlation between school enforcement and school-reported immunization rates in the fall of 2015. Kindergarten data from the four rural school districts participating in the focus groups and interviews were not included in this analysis, as there was an inadequate sample of rural school districts participating in this project.

#### Measures

The CIRE used focus group responses to classify the seven urban school districts according to their enforcement practices: school districts that annually exclude noncompliant students were classified as annually enforcing school districts, and school districts that did not exclude noncompliant students were classified as

### Table 1. Example Focus Group Questions for School Administrators and Staff

<table>
<thead>
<tr>
<th>Questions</th>
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<tbody>
<tr>
<td>How and when do you notify parents of school immunization requirements?</td>
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<td>How does your school work with parents to obtain immunization records?</td>
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<tr>
<td>How does your school record immunization compliance? Do you use an electronic system, a paper-based system, or other?</td>
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<tr>
<td>What is your procedure if a student does not have an immunization record?</td>
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<td>If a child does not meet the immunization requirements required for school entry, what actions are taken at your school?</td>
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<tr>
<td>If a noncompliant child does not meet the requirements after the 30-day grace period, what actions are taken at your school?</td>
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<td>How does your school enforce the immunization requirements and exemption policy for students who do not submit immunization records?</td>
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<tr>
<td>What factors affect your decision to enforce/not enforce the immunization requirement?</td>
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<tr>
<td>What are your main challenges with implementing and enforcing the immunization policy?</td>
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December 2017
nonenforcing school districts. Kindergarten immunization rates were compared between: (1) all schools \( n=29 \) from two large school districts annually enforcing immunization requirements in the fall of 2015 (total number of kindergartners=1,602) and (2) all schools \( n=31 \) from five large school districts not enforcing immunization requirements in the fall of 2015 (total number of kindergartners=2,583).

Kindergarten immunization rates for each school were provided by the NDDoH’s Immunization Program in March 2016. Immunization rates were provided for polio, DTaP, MMR, hepatitis B, and varicella. A two-sided \( t \)-test comparing weighted least squares means with a Tukey–Kramer adjustment for multiple comparisons was used to determine if there was a statistically significant difference in mean immunization rates between enforcing and nonenforcing schools. Analysis was completed in April 2016.

In addition to comparing immunization rates in enforcing and nonenforcing schools, a unique opportunity presented itself during the study that allowed the CIRE to assess the correlation of a change to stricter enforcement of school immunization requirements with school-reported immunization rates in two school districts. In October 2015, an Assistant Attorney General of ND addressed school superintendents at the ND School Boards Association Conference. During this meeting, the Assistant Attorney General discussed ND’s immunization laws and rules for schools, the financial implications for schools that do not have 100% of children in compliance with state immunization requirements, and the potential liability of schools should an outbreak occur. This presentation motivated three school districts, which were among the five previously mentioned school districts not enforcing immunization requirements in the fall of 2015, to enforce immunization requirements to the point of student exclusion during the middle of the 2015–2016 school year for the first time in recent history. This gave the CIRE an opportunity to assess the correlation of a change in enforcement policies with school-reported immunization rates, exemption rates, and non-compliance rates in one school year. School districts that changed their enforcement practices during the 2015–2016 school year were classified as newly enforcing school districts.

To analyze the impact of a change in enforcement practices, a subset of school districts from the first analysis were selected to re-run their immunization data in the spring of 2016, which they are not normally required to do. The CIRE compared MMR and DTaP kindergarten immunization rates in these schools at two time points: fall 2015 and spring 2016. The change in immunization rates within the same academic year in the two newly enforcing school districts (total number of kindergartners in spring 2016=1,665) was compared with immunization rate changes in two control groups: (1) one annually enforcing school district (total number of kindergartners in spring 2016=611), and (2) one nonenforcing school district (total number of kindergartners in spring 2016=277) that increased its efforts towards compliance, but did not exclude noncompliant children. Three school districts from the first analysis were not included in the second analysis either because of lack of willingness or lack of resources (such as an electronic data system) to re-run school immunization data at the authors request. These included one annually enforcing, one newly enforcing, and one nonenforcing district.

School-reported immunization and exemption rates from the school immunization survey completed in November 2015 were used as fall 2015 data, and data were aggregated by district. The data were provided to the CIRE by the NDDoH in March 2016. Annually enforcing school districts all enforced immunization requirements and excluded students before the November deadline. All newly enforcing school districts enforced and excluded students between December 2015 and February 2016. At the request of the CIRE, school nurses, secretaries, and staff from the subset of school districts mentioned above provided the updated immunization and exemption rates in spring 2016.

**Statistical Analysis**

A weighted (based on the number of students enrolled in each school), two-way ANOVA model was used to assess differences in means for DTaP and MMR immunization rates and total exemption percentages between fall 2015 and spring 2016 based on the enforcement type of each school. These analyses were completed in March 2017. A statistically significant, two-tailed \( p \)-value cutoff of 0.05 and SAS, version 9.4, was used for all analyses.

**RESULTS**

In the fall of 2015, kindergarten immunization rates for all required immunizations were significantly higher in the schools that annually enforced immunization requirements than the schools that did not enforce immunization requirements \( p \leq 0.001 \), all vaccines; difference between means: DTaP=7.5%, 95% CI=3.9%, 11.1%; polio=6.2%, 95% CI=3.3%, 9.1%; MMR=7%, 95% CI=3.5%, 10.5%; hepatitis B=3.7%, 95% CI=1.5%, 5.9%; varicella=6.9%, 95% CI=3.4%, 10.4%) (Figure 1). As a group, annually enforcing schools achieved the Healthy People 2020 goals of having 95% kindergarten immunization coverage for
all of the required immunizations except varicella, whereas none of the goals were met in the nonenforcing schools.

When kindergarten immunization rates from fall 2015 and spring 2016 were compared among school districts with varying enforcement practices, the school districts enforcing immunization requirements had the highest immunization rates. In the school district annually enforcing immunization requirements, MMR and DTaP immunization rates were consistently high and there was not a significant change from fall 2015 to spring 2016 (difference between means: DTaP = $-2\%$, 95% CI = $-10\%$, 4%; MMR = $-1\%$, 95% CI = $-8\%$, 6%). In the two newly enforcing school districts, there was a significant increase in MMR and DTaP immunization rates (DTaP = 6%, 95% CI = 2%, 11%; MMR = 7%, 95% CI = 3%, 11%), and both school districts achieved Healthy People 2020 goals for MMR and DTaP kindergarten immunization rates in spring 2016. In the school district that did not enforce immunization requirements, there was an increase in MMR and DTaP immunization rates, but it was not statistically significant and they were not able to achieve Healthy People 2020 goals (DTaP = 3%, 95% CI = $-5\%$, 11%; MMR = 3%, 95% CI = $-5\%$, 11%). This increase may be attributable to increased efforts in this district to improve immunization compliance, short of excluding noncompliant children. Kindergarten immunization rate changes for MMR and DTaP among the three different types of school districts are shown in Figures 2 and 3.

In the two newly enforcing school districts, there was a large decrease in noncompliance rates. Before enforcement, approximately 6.55% of kindergartners in these school districts were not compliant with school immunization requirements. After enforcement, approximately 0.18% of kindergartners were noncompliant. Additionally, significant and extended absenteeism as a result of exclusion was not a significant issue in these schools. With total student populations of >9,000 and >11,000 students, these two school districts had exclusion rates of 0.14% and 0.24% during the 2015–2016 school year. Administrators noted that most excluded students were back in school within a few days of exclusion.

Of note, significant increases in the percentage of students with exemptions were not observed from fall 2015 to spring 2016 in the schools of the two newly enforcing school districts.

**DISCUSSION**

To date, little research has focused on the impact that school enforcement has on school-reported immunization rates. This study highlights how school enforcement of immunization requirements may play a significant role in assuring an adequately vaccinated population in each school. In ND, immunization rates were higher in enforcing school districts than nonenforcing school districts, and immunization rates increased significantly in newly enforcing school districts. At the beginning of the 2015–2016 school year, these school districts had hundreds of students that were noncompliant with statewide immunization requirements, and by requiring
these students to become compliant, school-reported immunization rates increased significantly.

It was the subjective impression of school staff that the students most commonly comprising the noncompliant population were either (1) students from out of state who did not have copies of their immunization records or (2) students that were undervaccinated and missing only a few immunizations, such as those required at age 4–6 years. School staff shared that very few children who were noncompliant were completely unimmunized. Knowing this, public health interventions can be targeted to try and decrease the number of noncompliant students in each school and increase school-reported immunization rates.

Higher immunization exemption rates were not seen in schools after they enforced immunization requirements for the first time. This suggests that most parents did not take advantage of ND’s convenient exemption option (only a parent’s signature is required to obtain an exemption) and, for the most part, immunized their children according to school requirements or submitted documentation of prior vaccination.

Even though enforcement did increase school-reported immunization rates, it is not possible to determine if this increase represents a true increase in immunization rates with a reduction in the risk of vaccine-preventable diseases, or just bringing already immunized children into documented compliance. However, from the focus groups conducted as part of this project, multiple healthcare providers, clinic nurses, and public health nurses gave unsolicited feedback that they witnessed an unusually large number of children coming into their clinics to receive catch-up immunizations after schools in their area began strictly enforcing immunization requirements. Although this anecdotal evidence is not proof that actual immunization rates increased, it is possible that the number of children that were completely up to date with their immunizations in these schools did increase because of enforcement.

Nationally, conversations have focused on eliminating personal belief or religious exemptions or making them more difficult to obtain in an effort to increase vaccination rates, as research has shown that immunization policy does impact immunization, exemption rates, and the incidence of vaccine-preventable diseases. California recently passed legislation removing all nonmedical exemptions for school entry, and Vermont has removed their philosophical exemption, but kept their religious exemption. Additionally, Michigan and Washington have both recently made exemptions more difficult to obtain, which has resulted in a decrease in the number of exemptions filed. However, states attempting to strengthen exemption policies find the process very difficult and unpredictable, and they often face strong opposition and even legal action, as is currently the case in California.

This study suggests that a change in immunization and exemption policy may not be necessary for some states to increase school-reported immunization rates and achieve national immunization goals. In ND, a state with easily obtainable nonmedical exemptions, enforcing existing immunization policy appeared to be sufficient to achieve Healthy People 2020 goals for kindergarten immunization rates in several school districts. Nevertheless, exemption rates in the state have been increasing and a policy change making exemptions more difficult to obtain may be warranted in the future.

The findings from this study may have implications for other states with low immunization rates. As in ND, many states across the country have larger noncompliance rates than exemption rates. Knowing this, public health systems may consider dedicating time and resources to better understanding what constitutes their own noncompliant population. By reducing the noncompliant population by bringing children into compliance with state requirements, school-reported immunization rates could increase in many states, even without attempting to change immunization exemption policy.

Limitations
This study is subject to several limitations. First, analyses did not control for individual school characteristics, such as the availability of school nurses or demographic factors that could influence immunization rates. School administrators recognized school nurses as immunization champions that take the lead on assuring immunization compliance. Most schools in ND do not have school nurses, and those schools without school nurses may need to overcome additional barriers to achieve compliance. Additionally, nearly all of the data used in the project were aggregate school data, as individual student data were not provided by schools. Therefore, a change in vaccination rates could represent (1) a change in behavior of the noncompliant students, (2) a change in the individuals that entered or left a school, or (3) a combination of both. These analyses also used kindergarten data from large, urban school districts only, and the results may not be generalizable to small, rural school districts. Another limitation is that the analysis of immunization rate changes in the newly enforcing schools compared with the schools that did not change enforcement was limited in that the authors could only analyze those schools that were willing and able to recalculate their school immunization rates in the spring of 2016. Although the analysis had data on hundreds of students, there is potential for selection bias given that
the authors could not analyze all of the schools in the data set. Finally, these findings would likely not be generalizable to states with low noncompliance rates or without laws that allow for the enforcement of school immunization requirements to the point of excluding children from attendance.

CONCLUSIONS

School-reported kindergarten immunization rates have declined in recent years in ND, and although exemption seeking plays a role, it does not account for the majority of the decline. Many schools are not enforcing school immunization requirements to the extent of excluding noncompliant children from school, and these schools reported lower immunization rates. Enforcement of school immunization rates was strongly associated with low noncompliance rates and higher immunization rates. The role of school enforcement and its impact on noncompliance rates and its potential to improve immunization rates should be further explored in other states.

ACKNOWLEDGMENTS

The authors of this paper would like to acknowledge Abby Gold, PhD, Danielle Pinnick, MPH, and Nathan Fix, MPH, for their assistance with focus group facilitation. The authors would also like to thank the North Dakota Department of Health Immunization Program for providing school immunization data, specifically Amy Schwartz, MPH, and Lexie Barber, MPH. The authors would like to thank participating school administration and staff for calculating and providing updated school immunization data and feedback in spring 2016.

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Kylie Hall was the primary author of this manuscript and reviewed and revised the manuscript. She oversaw all aspects of this project, including data collection and focus group facilitation. Molly Howell acquired the funding for this project, helped conceptualize this work, and proofread the manuscript. Dr. Rick Jansen completed all statistical analyses for this project and proofread the manuscript. Dr. Paul Carson supervised this project and also contributed to the manuscript via technical editing and proofreading.

These results were presented in abstract form during an oral presentation at the National Immunization Conference in Atlanta, GA on September 15, 2016.

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REFERENCES