REVIEW

School-located vaccination for adolescents: Past, present, and future and implications for HPV vaccine delivery

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ABSTRACT

Adolescents were first specifically targeted for school-located vaccination (SLV) in the 1990s when hepatitis B catch-up vaccination was recommended for all adolescents. SLV affords the opportunity to access adolescents at a time when their activities have developmental import and the patients have the capacity to decline repeatedly missing school and extracurricular events to get vaccinated. As noted above, SLV has been primarily reserved for brief catch-up interventions among youth, with routine vaccination recommendations quickly defaulting to the primary care provider. Now in 2016, with relatively disappointing adolescent immunization rates for the routinely recommended human papillomavirus (HPV) vaccine, the SLV option is one that could potentially help increase vaccination rates for a particularly effective, life-saving, 3-dose vaccination series. This article will serve as a brief review of the successful use of SLV in other countries, lessons learned when SLV was employed to immunize adolescents against hepatitis B in the United States in the late 1990s and early 2000s, and the current hopes and challenges for the future of adolescent SLV programming in the United States. Overall, the shift to the use of SLV to administer routinely recommend vaccine for adolescents will require careful planning to implement known strategies for accessing youth and in addition to new strategies designed to assure appropriate reimbursement for cost-effect SLV services. While not the best option for all adolescents, SLV provides an important opportunity to immunize youth with limited access to healthcare services in the community at large.

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Introduction

There is a long history associated with the use of school-located vaccination (SLV) in the United States. SLV was first implemented in the mid and late 1800s in the US when public health officials used the schools as sites for vaccination against smallpox; Massachusetts reportedly began the practice as early as 1850.¹ In the mid-1950s, the inactivated polio vaccine underwent vaccine trials using more than 1.3 million elementary school children in 1954, and rubella vaccine was administered in schools in the late 1960s. Schools have long been recognized as a great way to access many school-aged children at one time for vaccination campaigns. Immunization in the schools has recently been studied more systematically in some communities in the United States as a means to increase rates of influenza vaccination each year.

Adolescents were first specifically targeted for school vaccination in the 1990s when hepatitis B catch-up vaccination was recommended for all adolescents. SLV affords the opportunity to access adolescents at a time when they have little time to spare due to extracurricular activities that have developmental import. As noted above, SLV has been primarily reserved for brief catch-up interventions among youth, with routine vaccination recommendations quickly defaulting to the primary care provider. Now in 2016, with relatively disappointing adolescent immunization rates for the routinely recommended

human papillomavirus (HPV) vaccine, the SLV option is one that could potentially help increase vaccination rates for a particularly effective, life-saving, 3-dose vaccination series. This article will serve as a brief review of the successful use of SLV in other countries - focusing on New South Wales, Australia, lessons learned when SLV was employed to immunize adolescents against hepatitis B in the United States in the late 1990s and early 2000s, and the current hopes and challenges for the future of adolescent SLV programming in the United States.

To be clear, vaccination occurring in the context of school-based health centers (SBH) will not be specifically addressed in this article. SBCs are health centers located in or near schools and provide care to low-income children and adolescents; 56% of SBCs provide care to populations in addition to the host school's student population including: students from other schools, families of students, out-of-school youth, faculty and school personnel, and others in the community.² SBCs essentially function as community health clinics that are conveniently located for young people. The number of SBCs in the United States has nearly doubled in the past 15 y to approximately 2315 clinics across 49 states and Washington DC. Most of these clinics provide vaccination services; 86% offer influenza vaccine, 78% offer vaccines with diphtheria toxoid, tetanus toxoid, and acellular pertussis, 75% offer hepatitis B vaccine.² Although data are relatively sparse, due to their access to

students at school, studies have shown vaccination rates that are higher among teens attending SBCs versus those attending community health centers.^{3,4} Despite this relative success, we found no studies directly comparing immunization rates achieved just with a SBC on campus vs. a specific SLV program push; in fact, one researcher found that one SLV program initiated by an SBC struggled with issues similar to those presented in this paper.⁵ There were approximately 98,328 public elementary and secondary schools and an additional 30,861 private schools counted in the United States in 2011–2012, thus fewer than 2 percent of all schools have associated SBCs.⁶ Because most schools do not have access to an SBC and because SBCs encounter similar barriers to SLVs when initiating targeted vaccination programs, this paper will focus on SLV programs that are distinct from programming provided by SBCs.

The SLV strategy: New South Wales

SLV has been a successful strategy used in Canada, Europe, and Australia, for example.^{7,8,9} There are many obvious differences between the public health and medical reimbursement systems in these other countries and the United States – most notably that these other countries have fully publically funded immunization programs, yet success with these SLV programs has been achieved with significant public health impact. Australia, as an example, and more specifically New South Wales (NSW), has had school-located immunization programs in place for many years, the earliest of which was initiated in 1932.⁹ Various SLV programs in New South Wales were sustained from 1971–1998, depending upon the catch-up initiative or boost in vaccination rates required. Between 1999 and 2003, New South Wales delivered vaccines through general practices, and vaccine initiation rates plummeted; hepatitis B vaccination coverage during that time was estimated at 18% for those age 10–13 y. In 2004, implementation of the National Meningococcal C Vaccination Program served as a “catalyst” to reestablish strong school-located immunization programs in the schools – including high schools – through the Adolescent Vaccination Program. Meningococcal C vaccine, hepatitis B vaccine and dTpa vaccine catch-up initiatives were provided through the program.⁹

Currently, school-located programs in New South Wales routinely administer varicella zoster vaccine, HPV vaccine, and dTpa vaccine; the coverage rate for HPV vaccine series completion among 7th grade students in the New South Wales in 2012, for example, was 71%.¹⁰ This compares to a 2012 coverage rate for the third HPV vaccine among 13–17 y olds in the US of 33%.¹¹ The impact of Australia’s program has been a significant decrease in HPV-related disease even in a brief period of time.¹² Also in contrast to the United States, the Australian Government provides funding to each state to support the Adolescent Vaccination Program in New South Wales; vaccines, service provision, and the training of all involved personnel are covered by the funds. Each high school holds 3–4 vaccination clinics per year, timed appropriately for 3-dose series. Resources support the distribution of parent information packets and “Student Advice” cards as well as the collection of parent consent forms; parents must consent to each dose of vaccine.⁹ Australia has had many years of SLV experience, but the model the country has provided reveals the potential for significant

success in achieving high vaccination rates among adolescents in a relatively short period of time.

Brief history of adolescent SLV campaigns in the united states

In 1995, after a recommendation for vaccinating a targeted group of adolescents at high risk for acquiring hepatitis B (HB) resulted in low immunization rates, the Advisory Committee on Immunization Practices (ACIP) recommended the routine immunization of adolescents age 11–12 y who had not previously received the hepatitis B vaccine.¹³ The goal was to immunize adolescents who were too old to have received the vaccine recommended for all newborns as of 1991. This recommendation was the first routine recommendation targeting all adolescents since the Td booster was recommended for adolescents at a standard 10 y interval from the childhood series; the first ACIP immunization schedule published in 1983 included the Td booster for those age 14–16 y.¹⁴ The recommendation for hepatitis B was the impetus needed to develop a true immunization platform for 11–12 y olds in the United States.¹⁵ Adolescents were harder to access than infants and school-aged children; multiple catch-up, SLV programs were developed in the United States to reach adolescents for vaccination.

Some of the first programs were initiated when the hepatitis B vaccine recommendation was targeting only high risk youth. Between 1992 and 1994, programs were initiated in middle schools with students (age 11–13 years) considered to be at high risk for disease acquisition in San Francisco and New Orleans.¹⁵ In both of these programs, lessons on infectious disease and the immune system were reviewed with students in science classes, and school assemblies and presentations focused specifically on hepatitis B. Information and resources were sent home to parents, and a group incentive was used in San Francisco promising a party for the class that returned the most consent or refusal forms. Vaccines were offered for free on a voluntary basis. Overall, in 1993–94, 77% of 1481 targeted students in San Francisco, and in 1992–93, 79% of 654 targeted students in Baton Rouge consented to receive the hepatitis B vaccination series. Ninety-four percent of the San Francisco students who started the series in 1993–94 completed the series.¹⁶

After hepatitis B vaccination was routinely recommended to all adolescents and states required the series for secondary school entry, several other states and communities implemented SLV to help students “catch up.” In Denver, a free, voluntary SLV program provided hepatitis B vaccination to sixth graders in 18 middle schools during the 1996–97 school year in which 72% of the target population was enrolled.¹⁷ A free and voluntary program was also conducted between 1998–2001 in Houston, Texas, among 5th grade classes in 75 participating schools; in 1999–2000, 61% of approximately 8900 eligible students participated in the program.¹⁸ In 1996–97, a successful program was also conducted across the entire state of Hawaii among 5th graders; 84% of 14,333 eligible students in both public and private schools consented to participate and received vaccine free of charge¹⁹. Similar results were noted in New Mexico, Delaware, and Kansas City.²⁰ Uptake of vaccines provided during targeted vaccination campaigns for catch-up among older children and young

adolescents clearly have potential to reach and protect large numbers of youth.

Across program descriptions, several findings were notable during the hepatitis B SLV campaigns:

- cost analysis revealed that administration costs for these large campaigns can be cost effective. In Denver, the cost analysis revealed that per dose, the cost of vaccinating via SLV, including the costs of volunteers and the cost of vaccine (\$31), was significantly lower than immunizing via health maintenance organization (\$68), and lower still in comparison when the cost of lost wages of a working father was included in the analysis (\$118).¹⁶ In Hawaii, the program costs for administering the vaccine (excluding cost of the vaccine itself) were also within reason (\$13.98 per dose),¹⁸ and in Kansas City, administration cost per dose was found to be \$5.06 (including the cost of volunteers and excluding the cost of vaccine).²⁰
- group incentives that tap into peer pressure such as a pizza party for the class with the highest consent/refusal rates were noted to be helpful.¹⁶ In one study, schools nurses report obtaining parental consent as one of the most significant barriers to immunization in the schools and suggested the use of such incentives to help increase adolescent student participation rates.²¹
- Teacher and student involvement in the program by distributing and collecting forms, etc., improves participation rates in programming;²² the support of the school administration helps programs move forward.
- Educating parents and students and sending home clear and informative materials to parents that explain the risks and benefits of both disease and vaccination are critical to accessing parental consent for vaccination.^{20,22}
- Vaccine and administration provided for free to all participants is a strong incentive for parents.

Influenza vaccine: An annual event

More recently in the United States, immunization in the schools has been implemented for influenza vaccination. Because this vaccine is given annually, SLV has been successful at reaching children, in particular, in an efficient and timely fashion. A review of the literature written by Harry Hull and Christopher Ambrose in 2011 examined program outcomes and effectiveness; 13 published articles and 25 conference presentations were identified for the paper.²³ Most programs reported coverage rates of approximately 40–50% (range 7–73%), with elementary schools reporting higher rates than middle or high schools. Some programs reported differences in immunization rates based on socioeconomic and demographic indicators - a pattern seen in the hepatitis B experience as well,^{24,20,19,25} while some programs found no such associations. Hull's follow up indicates that the SLV clinics have resulted in a positive impact on preventing school absenteeism from school due to flu illness.²⁶

Parental perspectives on SLVs

The literature supports that parents are willing to have their children immunized against influenza via SLV programs. A

nationally representative survey conducted in 2010 found that 51% of parents surveyed would consent to have their child vaccinated against influenza using an SLV program.²⁷ Factors positively associated with likely consent included whether the child had been immunized previously with the vaccine, parental education level, and uninsured status. Focus group assessment of parental perspectives reveals that parents understand and appreciate the benefits of SLV including the convenience, decreased cost, and public health benefits; yet parents also put significant value on communication about the program, the vaccine risks and benefits, and the qualifications of those administering the vaccine to their children - issues primarily related to safety/trust.²⁸ Adolescents from both middle and high schools provided similar perspectives as parent groups on SLV programs for influenza vaccine when asked in focus groups; students clearly understood the concepts of herd immunity and convenience for themselves and their parents, and they, too, worried about knowing the qualifications of the provider administering the vaccine, making sure the environment is clean and safe, and making sure they do not get sick while at school.^{29,30}

Overall, parents are willing to consider having their children vaccinated using SLV programs,^{31,32} even when they have little to no experience with school-based health or SLV programs.³³ As with the hepatitis B experience, some studies found varying associations between socioeconomic/demographic factors and the reported willingness to participate in SLV programs, essentially with those least able to take off work to go to a provider's office and those without health insurance being more willing to partake in the programs.^{27,34} Interestingly, urban middle school parents' perspectives regarding consent for their child's participation in SLV programs was also influenced by the vaccines being offered. A study conducted in Houston Independent School District revealed that among 615 parents of 11–14 y old adolescents, 57% were willing to consider consenting for influenza vaccine while only 27% were willing to consent for HPV vaccine via a SLV program.³⁵ Among a small number of private school parents completing a similar questionnaire, fewer respondents reported being likely to participate in SLV programs overall, and a similar discrepancy was noted between the number willing to consent for the influenza (54%) versus the HPV (6%) vaccines.³⁶ Studies conducted in Georgia and Colorado revealed a similar disparity with more parents reporting a willingness to have their child vaccinated against flu (63%, 67%, respectively) vs. HPV vaccine (58%, 53%, respectively) via SLV program.^{37,36}

The "how to" for SLV programming: Implications for the present and future

The data presented thus far indicate that parents are, indeed, willing to have their adolescents vaccinated at school. There seem to be differences in reported willingness based on factors that vary geographically and based on the study, but there is certainly plenty of evidence that a large proportion of parents are willing to utilize SLV programs. However, do parental preferences actually translate into vaccination behaviors? As part of an SLV program conducted in Houston, parents completed questionnaires about their willingness to participate in such a program one to 2 months prior to the initiation of such a program. The questionnaires were given unique identifiers so they

could later be linked to students who returned consent/refusal forms for vaccination. Among parents who consented to have their children vaccinated in the program, 42% of them had previously stated they would *not* prefer a school as a vaccination site.³⁸ Essentially, the convenience of the program may have served as too great a temptation to turn down.

Some of the most salient concerns for the future of SLV programming have been discussed in recent publications among those who have developed and implemented SLV programs. There are many “lessons learned.” Successful SLV must be planned well in advance of the programming so all essential elements are addressed.³⁹ The Centers for Disease Control and Prevention have developed a complete and thorough website with ideas and materials to create a successful SLV program.³⁵ The website includes background information, how to plan for the number of staff needed, sample letters to stakeholders and parents and templates for consent forms, suggestions for recording and tracking vaccinations and maximizing participation, and reviews of relevant and pertinent laws.

Other programming issues that are critical to address include:

- strong partnerships must be developed between vaccinating agencies and schools.^{39,40,41} There must be buy-in from the school district level. Study has shown that the involvement of principals and other key administrators can create the expectation that an SLV program will be successful. SLV program personnel must emphasize the benefit to administrators in terms of lowered school absenteeism or health alerts that could disrupt learning. Keeping a healthy student body is critical to learning. Communication and collaboration can help programs avoid scheduling during critical school testing times, minimize disruption to instructional time, and develop strategies to ensure privacy laws for schools are followed closely.
- programming personnel must do the majority of the work – Schools are very much in the business of educating students, and they are already stretched thin at that. It is important that SLV programs provide all of the administrative resources needed to conduct such a program. That will allow teachers and administrators to support the programs with encouragement, reminders, education of the students, and perhaps even form collection, but the brunt of the work must be completed by the program itself.⁴²
- Education and communication – It is critical to make sure parents, students, teachers and school administrators fully understand the importance and safety associated with adolescent vaccination. Educational materials should be developed for all stakeholders and the importance of preventive health care and immunizations should be woven into student curricula to punctuate the importance of the information. Parents often prefer brief, targeted, and concise information sources.⁴³
- site and implementation details - Parents must be assured of the competence of vaccinators. Parents need to be assured of the safety of the vaccines, the credentials of the vaccinators, and the ability of the site to manage any unforeseen side effects from vaccination.³⁰

In addition, for those parents who worry about being present for their child’s immunization, programs should be present either before or after instructional hours so that parents wishing to be present may attend.³⁷

- Voluntary participation – Parents clearly prefer opt-in programming.^{28,46}
- use of Immunization Information Systems – Record-keeping and the reporting of vaccination to state registries is very important to parents⁴³ who want to make sure their children do not have to receive additional vaccinations, and to the public health system in the context of appropriate use of resources. Any SLV must take responsibility for reporting completed vaccinations to the appropriate registry. This completes the link of information available to primary care providers. In addition, programs usually report vaccinations to the school and provide parents with a hard-copy record as well. This helps address a common parental concern of “record scatter”.⁴⁵
- consent from parents – Specific attention must be paid to collecting parental consent or refusal forms. Automated phone call reminders, fliers, emails might be helpful tools to remind parents to return forms. The CDC recommends the use of class incentives; individual incentives may help, but the evidence does not support their use. This piece of programming is worth significant administrative attention.

Specific challenges for SLV

Perhaps one of the most important issues that continues to be a bit of a “moving target” is the issue of financial reimbursement for programming via program billing. Nearly all of the studies reviewed above provided vaccine and vaccination services for free to all participants. The vaccine was either provided from pharmaceutical companies, via grant monies, or via the Vaccines for Children (VFC) program. In the case of the SLV programs in Australia and abroad, the government funded the programs including the vaccines. We know that SLV programs can be cost effective; if SLV programs are to become a viable option for immunizing youth, a huge piece of the puzzle for more widespread program rollout is figuring out the billing and payment concerns so programs can be self-sustaining. As implementation of the Affordable Care Act becomes more routine, “if an individual or family enrolls in a new health plan on or after September 23, 2010, then that plan will be required to cover recommended preventive services without charging a deductible, copayment or coinsurance”.⁴⁶ For those who are 18 y of age or younger and do not have health insurance or have Medicaid, vaccines are supplied by the Vaccines for Children program. Thus, ideally, the administration costs associated with vaccination – even vaccination associated with SLV – should be reimbursable for nearly all children. However, having to bill insurances and Centers for Medicare and Medicaid Services adds an additional layer of complexity to SLV programming. Programs have incorporated these elements with some difficulty. One program needed to create multiple “place of service” codes for each school in order to have private insurers reimburse the program.⁴⁷ Health Maintenance Organizations may not reimburse for a vaccine provided out of network at a

school.⁴⁷ Parents have expressed concerns about getting billed for school-located services; in one parental survey conducted by a research team in Aurora, Colorado in 2010, 42% of respondents were worried that they would receive a bill if their insurance company were billed for the vaccine.⁴⁵ This same team implemented an SLV program⁴⁸ that billed private insurance as well as VFC and recouped 41% of total program costs.⁴⁹ As insurance coverage increases in the United States, the potential to sustain programs financially will continue to grow. Programs will need to add a layer of financial administration to their operating budgets in order to collect appropriate reimbursement for vaccinating SLV participants.

The future of administering vaccines in school settings must include the delivery of all routinely recommended adolescent vaccines. That includes the HPV vaccine. Many have been concerned by the parental surveys described above indicating that parents would be less likely to have their children immunized in a school setting with the HPV vaccine. This may, however, be another example of reported perspectives not necessarily reflecting actual vaccination behaviors. Several SLV programs have been conducted that include the HPV vaccine. Initiation rates of HPV vaccine were higher when HPV was offered the context of other adolescent vaccines, although this review did not describe rates of uptake of the other offered vaccines in the various SLV programs.^{51,43} In an SLV program offered to middle school students in Houston that offered all adolescent vaccines including influenza vaccine and catch-up for hepatitis B, measles, mumps, and rubella, and hepatitis A vaccines, 86% of the unique participants in the program received the HPV vaccine.⁵²

It is worth noting that some of the more recent SLVs described in the literature that address all routinely recommended vaccines are not reporting participation rates similar to rates described in previous vaccination campaigns. The Houston program described above, for example, while able to immunize most participants with HPV vaccine, was still not been able to reach high percentages of eligible participants overall despite offering the annual flu vaccine (knowing that most adolescents had not yet received it). Participation rates in the fall clinic varied per school from 3.4% to 10.3% of the student population.⁵³ When offering vaccines that are routinely recommended, it is unknown what percentage of nonparticipants have already received all of their vaccines and do not require any vaccines from the program. Participation rates associated with catch-up campaigns and vaccines that are time-dependent (influenza vaccine at a time of a pandemic, for example) are likely to be much higher given the perceived urgency when compared to participation rates associated with SLVs offering routinely recommended vaccines. Despite lower participation rates, it is worth noting that these percentage increases can directly and indirectly impact the health of large absolute numbers of adolescents. As consistently posited, not all adolescents in the United States will avail themselves of SLV; but for a percentage of youth, it may be the only access and the most cost effective access to needed vaccines that they have.

Support for SLV

In general, there are some wonderful advantages to using SLV for adolescents: adolescents need not miss their school or extracurricular activities; parents need not miss work; and many

adolescents are available at one site. Greater immunization rates translate into herd immunity benefits within the schools as well. Potential disparities created by a parent's ability to miss work or access a primary care provider are eliminated – or at least mitigated. Again, SLV may not be the ideal vaccination strategy for all youth. In 2007, the American Academy of Pediatrics along with the American Academy of Family Physicians, the American College of Physicians, and the American Osteopathic Association created a document entitled, “Joint Principles of the Patient-Centered Medical Home;” this document sets forth the goal that all children and adolescents receive accessible, continuous, comprehensive care inclusive of a trusting partnership between the family and the care-giver(s).⁵³ Ideally, all vaccinations are administered in one place, are documented in one record, and are tracked accurately by one system of care. An estimated 80% of vaccinations administered to children and adolescents in this country are, in fact, administered by private providers.⁵⁴ However, for many children who do not have easy access to a primary care provider, SLV offers vaccination in a trusted environment, thus allowing for greater rates of individual protection and the indirect benefit of herd immunity within the school as more students are protected. With collaboration and communication among providers and schools, continuity of care is maintained. SLV programs have the opportunity to direct youth without primary care to appropriate resources within their communities. Some may argue that SLV may take patients away from the medical home at a time when adolescents need comprehensive healthcare and anticipatory guidance addressing risk behaviors more than ever; it has been hoped that vaccines may be the “hook” that will bring adolescents in to comprehensive health care.^{55,56} It is critical that adolescents receive life-saving and effective vaccines *and* receive comprehensive healthcare and counseling; however, there are true risks to holding one preventive health strategy hostage to another. In other words, if an effective strategy exists to increase immunization rates using school-located programming, vaccination should not be withheld in an effort to use it as a tool to bring adolescents in to the medical home for complete care. A different and creative strategy must be used to draw adolescents to primary care that does not potentially impinge on vaccination rates.⁵⁷

At this time, more organizations are supporting the concept of SLV to help increase adolescent immunization rates in this country. The National Association of School Nurses (NASN) supports SLV,^{58,59} and a summit meeting that include NASN, the National Association of County and City Health Officials (NACCHO), and the Association of State and Territorial Health Officials (ASTHO) conducted in November, 2010 voiced support for the development of a sustainable approach to SLV,⁶⁰ the Institute of Medicine supports the use of alternative sites as needed for adolescent immunization,⁶¹ the Society for Adolescent Health and Medicine⁶² and the President's Cancer Panel⁶³ have all supported the use of alternative venues for immunization to maximize immunization rates for vaccines among adolescents. SLV is a concept that the evidence indicates can work. With efficient planning, public health support, appropriate education of all stakeholders, and a lot of work on the front end, the potential for improving adolescent immunization rates is as great as our willingness to strive for it.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

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