SUPPLEMENT ARTICLE

Delivering Adolescent Vaccinations in the Medical Home: A New Era?

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ABSTRACT

BACKGROUND. Medical homes are health care settings that offer continuous, comprehensive, accessible primary care; these settings generally involve pediatric and family physician practices or community health centers but can also involve gynecologists or internists.

OBJECTIVES. In this article, we review available evidence on the role of the medical home in optimizing adolescent immunization delivery, particularly with respect to health care utilization patterns and barriers to vaccinations in medical homes, and solutions.

METHODS. We conducted a systematic review of the existing immunization and adolescent literature and used a Delphi process to solicit opinions from content experts across the United States.

RESULTS. Most adolescents across the United States do have a medical home, and many pay a health care visit to their medical home within any given year. Barriers exist in regards to the receipt of adolescent immunizations, and they are related to the adolescent/family, health care provider, and health care system. Although few studies have evaluated adolescent vaccination delivery, many strategies recommended for childhood or adult vaccinations should be effective for adolescent vaccination delivery as well. These strategies include education of health care providers and adolescents/parents; having appropriate health insurance coverage; tracking and reminder/recall of adolescents who need vaccination; practice-level interventions to ensure that needed vaccinations are provided to eligible adolescents at the time of any health care visit; practice-level audits to measure vaccination coverage; and linkages across health care sites to exchange information about needed vaccinations. Medical homes should perform a quality improvement project to improve their delivery of adolescent vaccinations. Because many adolescents use a variety of health care sites, it is critical to effectively transfer vaccination information across health care settings to identify adolescents who are eligible for vaccinations and to encourage receipt of comprehensive preventive.

CONCLUSIONS. Medical homes are integral to both the delivery of adolescent immunizations and comprehensive adolescent preventive health care. Many strategies recommended for childhood and adult vaccinations should work for adolescent vaccinations and should be evaluated and implemented if they are successful. By incorporating evidence-based strategies and coordinating effectively with other health care sites used by adolescents, medical homes will be the pivotal settings for the delivery of adolescent vaccinations.

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Key Words
medical home, vaccinations, preventive care

Abbreviations
STI—sexually transmitted infection
AAP—American Academy of Pediatrics
VFC—Vacccines for Children

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ADOLESCENTS PLAYED A prominent role in the 2000 Institute of Medicine[1] analysis of 26 candidate vaccines considered for use against diseases that are significant threats to public health. Recent licensure of meningococcal, pertussis, and human papillomavirus[2–4] vaccines highlighted the need to focus on the delivery of vaccinations

to the adolescent population. New vaccines[5] are being developed to protect against other sexually transmitted infections (STIs) such as genital herpes simplex virus, *Chlamydia trachomatis*, and *Neisseria gonorrhea*, as well as HIV, cytomegalovirus, respiratory syncytial virus, and group B streptococcus.

Implementation of adolescent vaccinations represents both a challenge and an opportunity to engage adolescents, their parents, and health care providers in a strategy to optimize both vaccination delivery and the receipt of comprehensive preventive health care. At the center of this strategy lies an ongoing source of coordinated, family-centered care, or the medical home.

In this article we examine the role of the medical home in optimizing adolescent immunization delivery and consider (1) adolescent health care utilization patterns with regards to the medical home, (2) barriers to adolescent immunizations in the medical home and possible solutions, and (3) overlap between medical homes and complementary sources of health care.

Between February and December, 2005, we assessed the available evidence base for the role of the medical home in adolescent immunizations. We reviewed the peer-reviewed literature, materials published by the Centers for Disease Control and Prevention, American Academy of Pediatrics (AAP), and other professional organizations, and presentations and materials known to us. We used a Delphi process[6] to solicit and examine written opinions from immunization and adolescent health care experts. Persons external to the group contributed opinions on adolescent utilization of health care, barriers to care, strategies for overcoming barriers, the interrelationship between medical homes and complementary settings, and national-level strategies for professional organizations to optimize adolescent immunization delivery.

THE MEDICAL HOME AND HEALTH CARE UTILIZATION OF ADOLESCENTS

Adolescents 11 to 21 years of age represent >40 million persons, or 14% of the US population.[7] The AAP and other organizations recommend that all adolescents receive primary care within a medical home, which is defined as a health care setting that is "accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective."[8] Critical elements of the medical home include preventive, acute, and chronic illness care,[9] initial-contact care for new problems that is available at all times, comprehensive care, longitudinal care, and coordinated care[10] by providers who are familiar with the family and the adolescent's cultural environment. Such settings typically include primary care pediatric and family medicine practices and federally qualified community health centers. For older adolescents, internal medicine practices may serve this role, and for some adolescent girls, gynecologists may serve as medical homes. Some health care sites that are considered as complementary settings, such as teen centers (see the article by Schaffer et al[11] in this issue), may function as medical homes if they provide comprehensive services.

A variety of preventive services are recommended to be delivered during adolescent preventive care visits to medical homes[12–15] (see the article by Broder et al[16] in this issue). These services range from screening for disease by using patient history, physical examination, and laboratory tests to anticipatory guidance about a variety of topics. Adolescent immunizations have traditionally comprised a small part of these preventive services, because few vaccines were administered to this age group.

The type of primary care providers seen by adolescents for health care visits varies according to their age.[17] Recent analyses (Fig 1)[18] by the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey showed that among early (11- to 14-year-olds) and middle (15- to 17-year-olds) adolescents, more than two thirds of health care visits are made to pediatric or family practice physicians. Among older adolescents (18–21 years old), less than half of all health care visits are to pediatricians or family physicians, particularly among females. Among older female adolescents, the majority of visits are to gynecologists, whereas male adolescents often do not have any contact with the health care system. Subspecialty visits are common, and most are with specialists in orthopedics, dermatology, and psychiatry, who tend not to provide routine immunizations. Many adolescents use a combination of health care settings for care, including primary care offices, family planning clinics, emergency departments, and community health centers.[19–21]

Most adolescents do report having a usual source of health care.[20] In 1 study of adolescents attending grades 5 through 12, the majority reported having a traditional medical home setting as their usual source of care, including a physician's office (62%), a clinic (24%), a hospital (7%), and an emergency department (5%). In addition, 81% reported having a usual sick-care provider.[19]

The pattern of adolescent preventive health care visits is similar to their overall visit pattern, with younger adolescents being more likely than older teens to have preventive visits (see the article by Broder et al[16] in this issue). For reasons that are unclear, there is a discrepancy between rates of preventive visits, depending on the source of information. Self-reported data from national surveys of adolescents or parents have suggested that more than two thirds of adolescents have a checkup within the past year (depending on the age group),[19,22] whereas Health Plan Employer Data and Information Set chart review measures in 2000 revealed that, nationally, only one third of adolescents had at least 1 preventive visit in the previous year.[23]

Some adolescents do not receive any health care.[20,24] Across the entire spectrum of US adolescents aged 11 to 21 years in 2002, 29% of females and 39% of males reported not having any health care visits in a 12-month period.[20] Uninsured and nearly poor adolescents are more likely to lack a health care visit.[22] In a review performed in 2003, half of the studies of adolescent utilization of primary care services showed that black and Hispanic adolescents received less primary care than did white adolescents, and half showed that all 3 groups received equal care.[25] When all adolescents under the age of 18 are included, most studies have identified a disparity in primary care use, with lower levels among

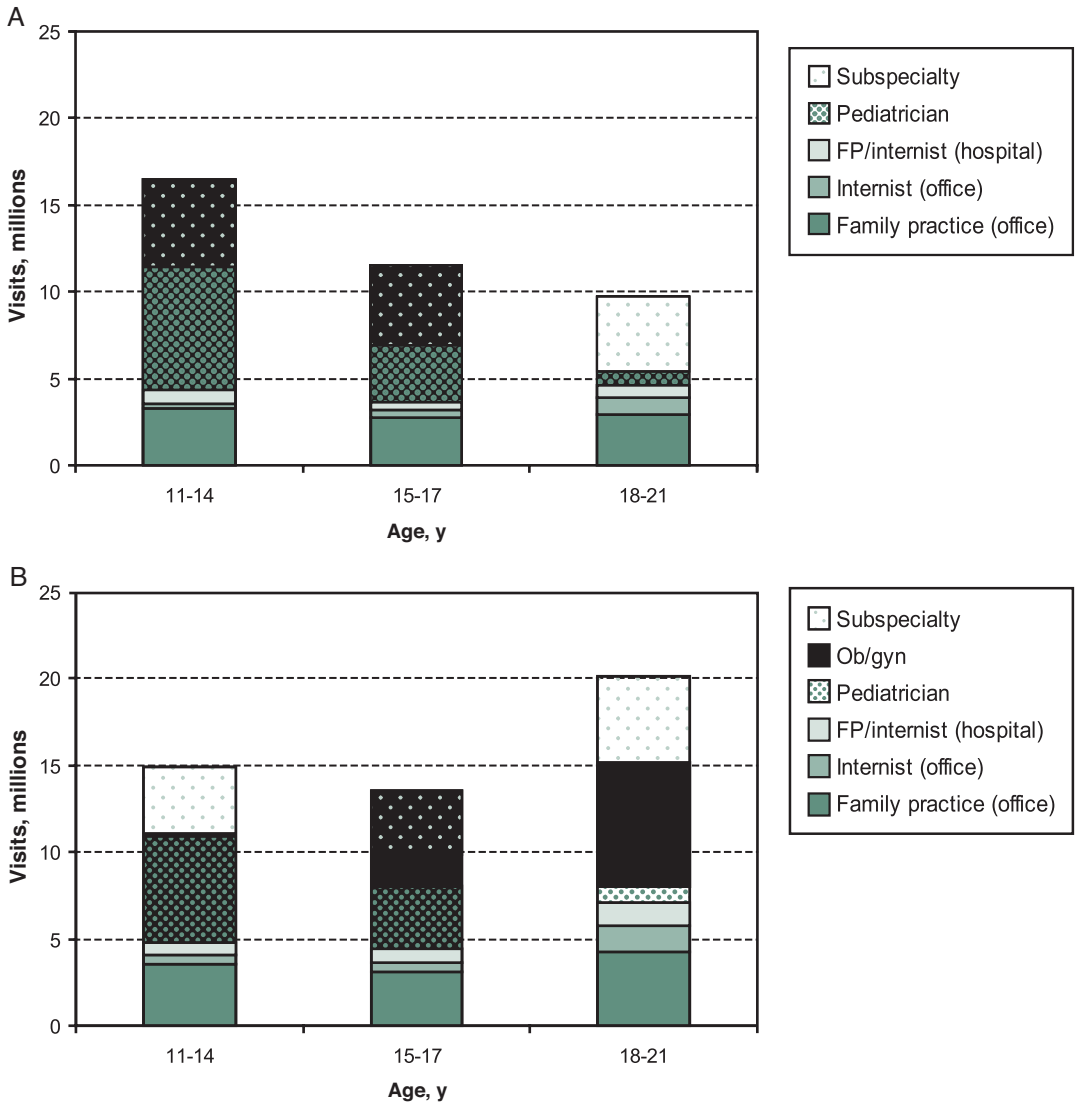

FIGURE 1
Average annual number of health care visits by adolescents across the United States: 2000–2002. Shown are the overall visits for boys (A) and girls (B). FP indicates family practice; Ob/gyn, obstetrics/gynecology. Source: analyses of the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey.[18]

black and Hispanic adolescents. Rural adolescents are equally likely to have health care visits as those living in urban areas.[26] Males are less likely to have a health care visit in the past year than females. Adolescents who are involved in sports activities, are infrequent or nonsmokers, and are sexually active are more likely than their counterparts to report having a checkup in the past year.[27]

In summary, medical homes are the major source of health care among adolescents and are critical for delivering comprehensive care. Most adolescents do report having a medical home, and some studies have reported that most adolescents have a health care visit within 1 year to their medical home. Most medical homes for adolescents involve primary care pediatric and family physician practices, although the role of these settings is diminished among older adolescents who are more likely to visit gynecologists or specialists and to lack any health care visits.

BARRIERS TO ADOLESCENT IMMUNIZATION DELIVERY IN MEDICAL HOMES AND PRACTICAL SOLUTIONS

Table 1 contains a summary of barriers (and solutions) to adolescent immunizations, which are grouped into 3 overlapping categories[28]: adolescent/family, health care providers, and the health care system. Because barriers vary across health care settings,[25,29] medical homes and communities should assess their own barriers to address those that are the most relevant.

Adolescent and Family

Lacking a Medical Home or Preventive Visits

Because a medical home and a preventive visit are often the entrée to preventive services, lacking either of them results in a major challenge to immunization delivery. Education of adolescents and parents about the importance of a medical home and preventive care visits

TABLE 1 **Barriers and Solutions to Adolescent Immunizations**

Category	Barriers[a]	Solutions
Adolescent or family	No medical home	Education from multiple sources
	No preventive visit	Education, reminders from many sources
	Costs (for health care visit or vaccine)	Health insurance (eg, increase VFC coverage until 21 y)
	Schedule; unaware of need for vaccine	Vaccination cards, patient reminders
	Safety concerns	Education from multiple sources
	Consent and confidentiality issues	Education from multiple sources
	Health beliefs (importance of vaccines)	Education from multiple sources
	Other activities having higher priority	Education from multiple sources
	Pain of vaccines and multiple shots	Pharmacologic and complementary care
Health care providers	Complicated agenda for adolescent preventive services (many issues to cover)	Standing orders for vaccinations; practice-level changes
	Missed opportunities for vaccination	Policy changes with self-audits, office guidelines, standing orders
	Schedule: not recommending annual visits	Policy changes (provider groups)
	Implement reminder/recall systems, link with registries	Implementing systems; link with registries
	Not using recommended strategies	Practice-level changes
	Lack of quality assurance process within the practice	Comprehensive Assessment Software Application for adolescent vaccines; health maintenance organizations; quality improvement
	Costs	VFC program and insurance policies
	Health beliefs	Provider education
	Consent and confidentiality issues	Provider education (eg, about laws)
System	No medical home for many adolescents	Integrate medical home with other sites, insurers; outreach
	No preventive visit	Integrate medical home with other sites, insurers; outreach
	No tracking of individuals needing vaccines	Registries, managed care, health systems universal vaccines
	Costs for health care or vaccines	VFC program for adolescent vaccines (until 21 y)
	Scattering of health care across sites	Managed care and other systems
	Lack of uniformity of state vaccination laws	School vaccination laws and school-entry requirements; legal counsel
	Lack of uniformity of interpretation of laws	Clarification of consent
	Lack of uniformity of guidelines	Provider groups and state recommendations
	Insufficient education about vaccines	School-based education Vaccine Information System forms and other materials

[a] Barriers are ordered within each category according to importance, as measured by author and expert consultant rankings. These barriers are applicable to the medical home but may also apply to vaccinations received elsewhere.

should stem from multiple sources including health care sites, schools, and the media.[30]

Cost

As adolescents assume greater responsibility for their own health care, direct costs of health care visits and immunizations and indirect costs such as time lost from work or school can become barriers to immunizations. In addition, health insurance coverage often declines after the age of 18.[31] In 2002, 12% of 10- to 18-year olds were uninsured,[32] whereas during the same period, 33% of men and 27% of women among 19- to 24-year olds were uninsured.[33]

Note that the Vaccine for Children (VFC) program covers adolescents <19 years old, but no such program exists for adults. In addition, some experts are concerned about the recent insurance-related trend toward consumers having to pay more out-of-pocket costs for primary care services[34] (some possible solutions are discussed in "Health Care System" below).

Knowledge, Health Beliefs, and Concerns About Vaccinations

Many adolescents lack knowledge about recommendations for annual preventive care visits.[35] Although most teens value preventive health care, practical barriers such as time and conflicting activities may interfere with their attendance to these visits. It is interesting to note that, although safety concerns[36] and overall motivation are often cited as patient barriers to vaccination, there is little evidence that these are major barriers for the general population,[37] and they are unlikely to be any more problematic among adolescents or their parents than they are among parents of younger children. The pain of injectable vaccines[38] is a potential practical barrier for some adolescents who may either refuse vaccination or miss health care visits because of their concern about injections.

Immunization experts have described a knowledge gap in regards to immunizations in that neither parents/adolescents nor health care providers recognize those individuals who need vaccinations at a particular time.[39,40] The solution rests in providing timely information to both families and health care providers so that everyone recognizes when an adolescent requires a vaccination. Unfortunately, this solution is one that is easier said than done. One strategy involves better education for parents and adolescents about the need for follow-up visits at a particular time. The use of handheld immunization cards has not been adequately studied in the United States. A second strategy involves the use of provider-based reminders/recall systems, which have been found to be effective in many,[41–44] but not all, settings for young children and adults.[45–47] It is notable that a recent randomized clinical trial of telephone reminder/recall for urban adolescents observed small but significant improvements in immunizations and preventive visits.[42] A third potential strategy is to enlist the help

of schools in educating parents and adolescents about the need for vaccinations at certain ages; this could be performed as part of the fall registration, the annual health assessment, or during health class.

Safety concerns need to be addressed with proper education, including the use of magazines, television, newspapers, and the Internet; media sources that are used by adolescents.[48] To address concerns about the pain of vaccinations,[49] medical homes and other settings might consider the use of either pharmacologic numbing agents or complementary medicine strategies such as relaxation techniques that have been studied among school-aged children[50] but are likely to be equally important for fearful adolescents.

Consent and Confidentiality

Consent[51,52] and confidentiality[19,53] are relatively unique barriers in this age group (see the article by English et al[54] in this issue). Many older adolescents attend health care visits by themselves but cannot provide consent for immunizations. There is a lack of clarity about laws in regards to the need for parental consent for vaccines that protect against STIs, and substantial variation exists across states in the wording and interpretation of vaccination laws. Also, it may be more difficult when parents are present, than when they are not, for providers to discuss sensitive topics such as STIs and their prevention with adolescents. This may become increasingly relevant, because discussion of the STI-related vaccines such as human papillomavirus may often lead to a discussion of sexuality. Parental consent is required for other vaccines such as those against pertussis, meningococcal, and influenza. Confidentiality and health beliefs need to be addressed forthright within medical homes by using appropriate policies and procedures and cultural sensitivity.

Health Care Providers

Provider barriers to timely vaccination delivery have been described for young children and adults, but they also apply to adolescents. Missed opportunities for vaccinations[55,56] (health care visits at which a patient is eligible to receive a vaccination but does not receive one) are particularly important, because adolescents have fewer visits than do younger children. In addition, some providers still recommend biennial preventive visits for adolescents, although most current guidelines recommend annual preventive visits.[14,15]

Health care providers should take advantage of new adolescent vaccination guidelines to review their own practice's overall vaccination efforts. Table 2 shows 6 quality improvement steps (adapted from quality improvement principles) for optimizing adolescent vaccination delivery within medical homes. Each medical home should have a core group that sets the practice's policies and procedures and reviews and adopts evidence-based strategies[41,43,44] for optimizing vaccination delivery. On the basis of the principles of quality improvement, we suggest that each practice perform 1 small-change intervention to improve adolescent immunization rates and assess the impact of the intervention by using simple measures. For example, a practice may wish to reduce missed opportunities and measure the impact of a policy change of vaccinating eligible adolescents during all medical encounters. Another practice may develop better communication strategies with school-based health centers or health departments for updating vaccination records. A third practice may use billing or electronic medical chart systems to develop a patient-reminder system for influenza vaccination for eligible adolescents at high risk. The key is to measure the impact of these changes. Also, medical homes should develop a method for assessing adolescent vaccination coverage by using such strategies as free chart-review assessments by their local public health department (by using the Comprehensive Clinical Assessment Software Application at www.cdc.gov/nip/cocasa), linkages with immunization registries containing adolescent immunizations, and coordination with managed care.

TABLE 2 Quality Improvement Steps to Optimize Adolescent Vaccination Delivery Within Medical Homes

Set up a multidisciplinary vaccination team that is in charge of evaluating and improving vaccination delivery (for all relevant age groups)
Develop office-based policies and procedures for new adolescent vaccinations
Review evidence-based strategies for optimizing childhood or adult vaccinations and assess which strategies are being used within the office; implement strategies that might be feasible for adolescents
Perform 1 well-defined, feasible, and purposefully small office-based intervention to improve 1 aspect of adolescent immunization delivery
Measure vaccination coverage for the adolescent population and make adjustments on the basis of coverage
Collaborate with other sectors: managed care for Healthcare Effectiveness Data and Information Set measures, immunization registries for adolescent vaccinations, health care systems for electronic medical charts, including vaccinations, local health departments for practice-based Comprehensive Assessment Software Application audits, and other provider sites such as school health clinics for sharing vaccination records of mutual patients

Missed opportunities for vaccination represent low-hanging fruit, because it is easier to incorporate strategies for vaccinating the eligible adolescent during a medical visit than to implement strategies for generating health care visits.[57] Although rigorous studies have noted only limited success with interventions to eliminate missed opportunities in children[55,56] and adults,[58] interventions to reduce missed opportunities may still be more feasible than other strategies that require more resources.

The inability to track patients who need vaccinations or to perform systematic reminder/recall[59] is a known barrier for medical homes. Tracking, reminders, and recall are almost certain to be needed to achieve high adolescent vaccination rates[56,60] except in those populations in which adolescents already have high rates of health care visits.

In addition to costs being a barrier for individuals, the high costs of vaccines represent a barrier for health care providers and highlight the importance of adequate insurance coverage,[61,62] because medical homes need to purchase vaccines up front at considerable expense.[63] Possible solutions are discussed below.

Providers' health beliefs have been shown to affect

vaccination coverage in certain situations (eg, influenza, varicella, and hepatitis B vaccinations).[64–67] Professional organizations (eg, the AAP and the American Academy of Family Physicians) can reinforce the need for annual preventive visits and address health beliefs and safety issues regarding new adolescent vaccines. Studies have demonstrated that primary care providers pay attention to policies that are promoted by their professional organizations.[68]

Other barriers at the provider level are particularly relevant for adolescent vaccinations. Prioritizing adolescent vaccination in the setting of numerous critical health care issues may be difficult, because adolescent health care visits are often filled with discussions of multiple critical topics. Because many new vaccines relate to sexuality, the sensitivity of topics is an issue, particularly for young adolescents.[69]

Health Care System

Barriers include inadequate access to medical homes, lack of system-wide tracking, cost issues[57] such as inadequate health insurance coverage,[32] and the lack of uniformity of school laws or interpretation of state consent or other policies. The pattern of health care visits of adolescents, with frequent reliance by some adolescents on multiple sites, presents system-wide challenges of coordination and exchange of information. Consent can become a barrier in attempts to coordinate care across sites. Lack of insurance portability across state lines can also be a barrier.

Comprehensive insurance coverage of both vaccinations and preventive visits is critical for minimizing cost-related barriers to adolescent vaccinations and is particularly relevant for the new adolescent vaccinations, which are very expensive. Expansions in public insurance such as the State Children's Health Insurance Program[70,71] may improve access for low-income adolescents. However, the State Children's Health Insurance Program does not cover adolescents beyond the age of 18 years. The availability of additional funding to support vaccination of adolescents 19 to 21 years of age (who are no longer eligible for the VFC program) should be explored. Studies have noted that providing health insurance can improve immunization coverage for younger children.[27,72,73] The VFC program has enhanced immunization delivery within the medical home for infants and toddlers.[62,74] For the older-adolescent group, more extensive insurance coverage and adequate financing for health care providers might accrue similar benefits in improved vaccination delivery and promotion of the medical home. In addition, insurance benefits should be portable across both providers and state lines.

An important system-wide strategy involves coordinated, integrated care across medical homes, public health, and other organizations that serve adolescents. Integration across health care sites needs to be conducted at the local level, because the needs vary geographically. One method of coordination across health care sites is community-wide participation in immunization registries that include adolescents. Another strategy is more effective communication of vaccination information across sites, such as automatic faxed reports of immunizations received in complementary settings that are consistent with Health Insurance Portability and Accountability Act guidelines. Third, because managed care organizations have computerized records of many health care visits received by enrolled adolescents, they can implement patient reminders about needed services and provide medical homes with lists of adolescents who seem to be behind in recommended services; this would address family and provider needs simultaneously. State and federal public health organizations can provide educational materials and interpretation of laws, consent guidelines, and school-entry requirements to assist medical homes. Finally, multisite outreach programs that have been developed for young children to ensure receipt of preventive services[75] could be adapted for adolescents.

Schools can become an important factor in ensuring adolescent vaccinations, even if vaccinations are not actually administered by schools (see the article by Lindley et al[76] in this issue). One of the most important policy levers for immunizations is school-entry vaccination laws (see the article by Horlick et al[77] in this issue). A potential strategy might involve school requirements for preventive visits according to national guidelines. A third strategy is for schools to verify adolescent immunization records and encourage receipt of needed vaccines. This is one area in which a strategy can improve both vaccination coverage and receipt of comprehensive preventive care.

National, state, and local organizations can help overcome barriers at the level of parents/adolescents, health care providers, and the health care system. Table 3 lists key organizations that can promote effective adolescent vaccination delivery within medical homes. The first group is involved in strategies for the education of the general public and for outreach to vulnerable populations that may be disenfranchised from traditional medical homes. The second group, which overlaps substantially with the first group, focuses on primary health care settings. The third group includes organizations with influence on governmental and state policies and expertise in systems-level change.

Lessons Learned From Experiences With Recent New Vaccines

During the 1980s, a risk-based strategy for hepatitis B vaccine recommendations for adolescents was difficult for medical homes to follow, because health care providers could not easily determine who was at a high risk for the virus. Instituting a risk-based strategy for adults[78] and children who are eligible for influenza vaccine is equally challenging. Thus, universal adolescent vaccination is likely to be more effective than using a risk-based strategy. Second, during the 1990s, the introduction of varicella vaccine encountered variable buy-in among health care providers[40]; clinicians who tended to believe less in the vaccine may have had lower patient immunization coverage rates. New vaccine policy must be accompanied by targeted education of health care providers. Third, during the recent introduction of conjugate pneumococcal vaccine (Prevnar; Wyeth), the lack

TABLE 3 **National, State, and Local Organizations That Can Promote Adolescent Vaccination Delivery Within Medical Homes**

Overcoming adolescent and family barriers
Traditional medical professional organizations (AAP, American Academy of Family Physicians, National Association of Pediatric Nurse Practitioners, American Academy of Nurse Practitioners, American Academy of Physician Assistants, Society for Adolescent Medicine, Academic Pediatrics Association, American College of Physicians, American College of Obstetricians and Gynecologists, American Medical Association, National Association of Community Health Centers, Migrant Clinicians Network)
Traditional school-based partners in childhood immunizations (American Association for Health Education, National Association for School Nurses, American Association of School Administrators, Parent Teachers Associations)
Nontraditional organizations (Big Brothers, Big Sisters, athletic clubs, faith-based and community organizations)
State immunization coalitions (including the Association of Immunization Managers)
Overcoming health care provider barriers
Traditional medical professional organizations (see above)
The Partners in Program Planning for Adolescent Health[a]
Traditional school-based partners (see above)
Nontraditional organizations (see above)
State immunization coalitions (including the Association of Immunization Managers)
Quality improvement organizations (Institute for Healthcare Improvement, National Initiative for Children's Healthcare Quality)
Addressing barriers within the health care system
Traditional medical professional organizations, the Partners in Program Planning for Adolescent Health
Organizations focusing on coding (American Medical Association's *Current Procedural Terminology*, Association of Health Insurance Plans, individual insurers with national leadership)
Electronic medical charts and registries (Office of the National Coordinator of Health Information Technology, Health Information Management Systems Society)

[a] A multidisciplinary organization composed of representatives from a large number of stakeholders.

of VFC coverage and variability in insurance coverage for an initial period[79–81] created problems for providers within medical homes when it was time to decide which children to vaccinate. New vaccine policies should be accompanied by simultaneous VFC and insurance coverage. Finally, vaccine shortages highlight that any comprehensive strategy will be challenged if vaccines are not available.

Areas of Overlap Between Medical Homes and Other Sites of Adolescent Health Care

Adolescents often receive care at additional sites such as sports physical clinics held at schools, school health centers, precollege or premilitary physicals, teen clinics, STD or family planning centers, public health centers, homeless shelters, and faith-based outreach programs. In addition, many adolescents receive subspecialty care or are seen in emergency departments or urgent care settings for acute care.

In addressing the overlap between medical homes and complementary sites of care, 3 components of coordinated care need attention: (1) effectively transferring immunization-related information; (2) identifying adolescents who are eligible for vaccinations and ensuring timely vaccination; and (3) encouraging receipt of comprehensive primary care. Regarding the first issue, reciprocity of health and immunization information between sites of care should be routine. Examples of these tools are networked computer registries, electronic records, faxed immunization forms, and mailed copies of medical charts. The federal Migrant Health Program has been successful with a chart-tracking system in which the patient carries a wallet card that identifies them as belonging to a cooperative medical record–exchange system. Immunization registries developed for childhood vaccinations should be adapted for adolescent vaccines.

The second critical issue is to identify eligible adolescents and vaccinate them. Linkages between medical homes and alternative sites should be enhanced. In addition to transferring vaccination information, complementary sites could screen adolescents for eligibility for vaccinations and encourage them to receive vaccinations in their medical homes. Immunizations can be provided at complementary sites, or outreach can be focused on bringing adolescents to the medical home for vaccinations and comprehensive preventive services. Some local models of care have lay health workers or case managers who coordinate care among different providers while also educating parents and adolescents about the importance of preventive health measures.

Third, adolescents who receive acute or chronic care at a complementary health care site (whether they receive a vaccination) should be counseled that they still need a comprehensive preventive visit, which most likely would occur within the medical home.

CONCLUSIONS

Medical homes are optimally suited to provide adolescent immunizations in the context of comprehensive primary care. However, barriers exist in regards to the receipt of adolescent immunizations. These barriers are related to the adolescent/family, health care provider, and health care system. Many strategies recommended for childhood or adult vaccinations should be effective for adolescent vaccination delivery as well. These strategies include education of providers and adolescents/parents, appropriate health insurance coverage, and implementation of evidence-based strategies such as tracking, reminder/recall, standing orders, practice-level audits, and linkages across health care sites. Medical homes may wish to perform a quality improvement project to improve their delivery of adolescent vaccinations.

For a successful national adolescent immunization program, major professional organizations must coordinate educational efforts, public relations campaigns, and policies. Because adolescents use a variety of health care sites, it is critical to effectively transfer vaccination information across health care settings, identify adolescents who are eligible for vaccinations, and ensure that comprehensive primary care beyond vaccinations is received. Finally, the evidence base for optimal delivery of adolescent vaccinations is sparse, and research is needed

to evaluate optimal means of delivering vaccinations to the general adolescent population and to high-risk, vulnerable populations.

Efforts to enhance immunization of adolescents must occur within the context of the larger goal of improving overall preventive services for adolescents. From a standpoint of immunizations only, delivery of vaccinations at sites other than medical homes could be considered. For example, a school-based immunization program might be successful, avoiding medical homes altogether. However, just as for younger children and adults, adolescent immunizations are likely to be a marker of preventive services in general. Programs that separate adolescents from their medical home might result in a reduction of other preventive services. Conversely, programs that strengthen the delivery of adolescent immunizations within the medical home might improve additional adolescent preventive services.

Because most adolescents have and use a medical home, it is logical to build a national adolescent immunization program by using the medical home as a foundation. By incorporating evidence-based strategies to address and overcome barriers to immunizations, medical homes can become pivotal settings in the new era of adolescent immunizations.

WORKING GROUP ON ADOLESCENT VACCINATION IN THE MEDICAL HOME

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REFERENCES

1. Stratton KR, Durch JS, Lawrence RS, eds. *Vaccines for the 21st Century: A Tool for Decision-Making*. Washington, DC: National Academy Press; 2000
2. Bilukha OO, Rosenstein N. Prevention and control of meningococcal disease: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2005; 54(RR-7):1–21
3. Broder KR, Cortese MM, Iskander JK, et al. Preventing tetanus, diphtheria, and pertussis among adolescents: use of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccines recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2006;55(RR-3): 1–34
4. Markowitz L, Dunne EF, Saraiya M, et al. Quadrivalent human papillomavirus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2007;56(RR-2):1–24
5. Rickert D, Deladisma A, Yusuf H, Averhoff F, Brink E, Shih S. Adolescent immunizations: are we ready for a new wave? *Am J Prev Med.* 2004;26:22–28
6. Kennedy HP. Enhancing Delphi research: methods and results. *J Adv Nurs.* 2004;45:504–511
7. US Census Bureau. Census 2000 briefs: population by age, sex, race, and Hispanic or Latino origin for the United States: 2000. Available at: www.census.gov/population/www/cen2000/phc-t9.html. Accessed February 20, 2007
8. American Academy of Pediatrics, Ad Hoc Task Force on Definition of the Medical Home. The medical home. *Pediatrics.* 1992;90:774
9. American Academy of Pediatrics, Medical Home Initiatives for Children With Special Needs Project Advisory Committee. The medical home. *Pediatrics.* 2002;110:184–186
10. Starfield B, Shi L. The medical home, access to care, and insurance: a review of evidence. *Pediatrics.* 2004;113(suppl 5): 1493–1498
11. Schaffer SJ, Fontanesi SJ, Rickert D, et al. How effectively can health care settings beyond the traditional medical home provide vaccines to adolescents? *Pediatrics.* 2008;121:S35–S45
12. Elster AB, Kuznets NJ. *AMA Guidelines for Adolescent Preventive Services (GAPS): Recommendations and Rationale*. Baltimore, MD: Lippincott, Williams & Wilkins; 1993
13. US Preventive Services Task Force. Clinical categories. Available at: www.ahrq.gov/clinic/cps3dix.htm#pediatric. Accessed February 20 2007
14. Green M, Palfrey JS, eds. *Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents*. 2nd revised ed. Arlington, VA: National Center for Education in Maternal and Child Health; 2002
15. Elster AB. Comparison of recommendations for adolescent clinical preventive services developed by national organizations. *Arch Pediatr Adolesc Med.* 1998;152:193–198
16. Broder KR, Cohn AC, Schwartz B, et al. Adolescent immunizations and other clinical preventive services: a needle and a hook? *Pediatrics.* 2008;121:S25–S34
17. Ziv A, Boulet JR, Slap GB. Utilization of physician offices by adolescents in the United States. *Pediatrics.* 1999;104:35–42
18. Rand CM, Shone LP, Albertin C, Auinger P, Klein JD, Szilagyi PG. National health care visit patterns of adolescents: implications for delivery of new adolescent vaccines. *Arch Pediatr Adolesc Med.* 2007;161:252–259
19. Klein JD, McNulty M, Flatau CN. Adolescents' access to care: teenagers' self-reported use of services and perceived access to confidential care. *Arch Pediatr Adolesc Med.* 1998;152:676–682
20. Albertin C, Rand CM, Fryer G, Shone L, Schaffer SJ, Szilagyi PG. Adolescent healthcare utilization across the U.S.: who may be reached for immunization? Paper presented at: Pediatric Adademic Societies meeting, San Francisco, CA, April 29, 2006
21. Klein JD, Wilson KM, McNulty M, Kapphahn C, Collins KS. Access to medical care for adolescents: results from the 1997 Commonwealth Fund Survey of the Health of Adolescent Girls [published correction appears in *J Adolesc Health*. 1999;25:312]. *J Adolesc Health.* 1999;25:120–130
22. Yu SM, Bellamy HA, Schwalberg RH, Drum MA. Factors associated with use of preventive dental and health services among US adolescents. *J Adolesc Health.* 2001;29:395–405
23. Centers for Disease Control and Prevention. Immunization of adolescents: recommendations of the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, the American Academy of Family Physicians, and the American Medical Association. *MMWR Morb Mortal Wkly Rep.* 1996; 45(RR-13):1–16
24. Civic D, Scholes D, Grothaus L, McBride C. Adolescent HMO enrollees' utilization of out-of-plan services. *J Adolesc Health.* 2001;28:491–496
25. Elster A, Jarosik J, VanGeest J, Fleming M. Racial and ethnic disparities in health care for adolescents: a systematic review of the literature. *Arch Pediatr Adolesc Med.* 2003;157:867–874
26. Probst JC, Moore CG, Baxley EG, Lammie JJ. Rural-urban differences in visits to primary care physicians. *Fam Med.* 2002; 34:609–615
27. Ford CA, Bearman PS, Moody J. Foregone health care among adolescents. *JAMA.* 1999;282:2227–2234
28. Humiston SG, Rosenthal SL. Challenges to vaccinating

adolescents: vaccine implementation issues. *Pediatr Infect Dis J.* 2005;24(suppl 6):S134–S140
29. Klein JD. Adolescents, health services, and access to care. *J Adolesc Health.* 2000;27:293–294
30. Irwin CE Jr, Duncan PM. Health Futures of Youth II: pathways to adolescent health, executive summary and overview. *J Adolesc Health.* 2002;31(suppl 6):82–89
31. Irwin CE Jr, Burg SJ, Uhler Cart C. America's adolescents: where have we been, where are we going? *J Adolesc Health.* 2002;31(suppl 6):91–121
32. Newacheck PW, Park MJ, Brindis CD, Biehl M, Irwin CE Jr. Trends in private and public health insurance for adolescents. *JAMA.* 2004;291:1231–1237
33. Callahan ST, Cooper WO. Uninsurance and health care access among young adults in the United States. *Pediatrics.* 2005;116:88–95
34. McManus MA, Berman S, McInerny T, Tang SF. Weighing the risks of consumer-driven health plans for families. *Pediatrics.* 2006;117:1420–1424
35. Santelli J, Klein J, Graff C, Allan M, Elster A. Reliability in adolescent reporting of clinician counseling, health care use, and health behaviors. *Med Care.* 2002;40:26–37
36. Maldonado YA. Current controversies in vaccination: vaccine safety. *JAMA.* 2002;288:3155–3158
37. Freed GL, Clark SJ, Hibbs BF, Santoli JM. Parental vaccine safety concerns: the experiences of pediatricians and family physicians. *Am J Prev Med.* 2004;26:11–14
38. Woodin KA, Rodewald LE, Humiston SG, Carges MS, Schaffer SJ, Szilagyi PG. Physician and parent opinions: are children becoming pincushions from immunizations? *Arch Pediatr Adolesc Med.* 1995;149:845–849
39. Rodewald LE, Santoli JM. The challenge of vaccinating vulnerable children. *J Pediatr.* 2001;139:613–615
40. Orenstein WA, Douglas RG, Rodewald LE, Hinman AR. Immunizations in the United States: success, structure, and stress. *Health Aff (Millwood).* 2005;24:599–610
41. Briss PA, Rodewald LE, Hinman AR, et al. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. The Task Force on Community Preventive Services. *Am J Prev Med.* 2000;18(suppl 1):97–140
42. Szilagyi PG, Schaffer S, Barth R, et al. Effect of telephone reminder/recall on adolescent immunization and preventive visits: results from a randomized clinical trial. *Arch Pediatr Adolesc Med.* 2006;160:157–163
43. Shefer A, Briss P, Rodewald L, et al. Improving immunization coverage rates: an evidence-based review of the literature. *Epidemiol Rev.* 1999;21:96–142
44. Szilagyi PG, Bordley C, Vann JC, et al. Effect of patient reminder/recall interventions on immunization rates: a review. *JAMA.* 2000;284:1820–1827
45. Kempe A, Lowery NE, Pearson KA, et al. Immunization recall: effectiveness and barriers to success in an urban teaching clinic. *J Pediatr.* 2001;139:630–635
46. Kempe A, Beaty BL, Steiner JF, et al. The regional immunization registry as a public health tool for improving clinical practice and guiding immunization delivery policy. *Am J Public Health.* 2004;94:967–972
47. Davis MM, Szilagyi PG. Can quality improvement reach into pockets of need for childhood immunizations? *Ambul Pediatr.* 2004;4:224–225
48. Gray NJ, Klein JD, Noyce PR, Sesselberg TS, Cantrill JA. Health information-seeking behaviour in adolescence: the place of the internet. *Soc Sci Med.* 2005;60:1467–1478
49. Jacobson RM, Swan A, Adegbenro A, et al. Making vaccines more acceptable: methods to prevent and minimize pain and other common adverse events associated with vaccines. *Vaccine.* 2001;19:2418–2427
50. Cohen Reis E, Holubkov R. Vapocoolant spray is equally effective as EMLA cream in reducing immunization pain in school-aged children. *Pediatrics.* 1997;100(6). Available at: www.pediatrics.org/cgi/content/full/100/6/e5
51. Gordon TE, Zook EG, Averhoff FM, Williams WW. Consent for adolescent vaccination: issues and current practices. *J Sch Health.* 1997;67:259–264
52. Beh HG, Pietsch JH. Legal implications surrounding adolescent health care decision-making in matters of sex, reproduction, and gender. *Child Adolesc Psychiatr Clin N Am.* 2004;13:675–694
53. Litt IF. House calls? *J Adolesc Health.* 2001;29:237–238
54. English A, Shaw FE, McCauley MM, Fishbein, DB; Working Group on Legislation, Vaccination, and Adolescent Health. Legal basis of consent for health care and vaccination for adolescents. *Pediatrics.* 2008;121:S85–S87
55. Szilagyi PG, Rodewald LE, Humiston SG, et al. Reducing missed opportunities for immunizations: easier said than done. *Arch Pediatr Adolesc Med.* 1996;150:1193–1200
56. Sabnis SS, Pomeranz AJ, Amateau MM. The effect of education, feedback, and provider prompts on the rate of missed vaccine opportunities in a community health center. *Clin Pediatr (Phila).* 2003;42:147–151
57. Merkel PA, Caputo GC. Evaluation of a simple office-based strategy for increasing influenza vaccine administration and the effect of differing reimbursement plans on the patient acceptance rate. *J Gen Intern Med.* 1994;9:679–683
58. Centers for Disease Control and Prevention. Facilitating influenza and pneumococcal vaccination through standing orders programs. *MMWR Morb Mortal Wkly Rep.* 2003;52:68–69
59. Schaffer SJ, Humiston SG, Shone LP, Averhoff FM, Szilagyi PG. Adolescent immunization practices: a national survey of US physicians. *Arch Pediatr Adolesc Med.* 2001;155:566–571
60. Briss P, Shefer A, Rodewald L. Improving vaccine coverage in communities and healthcare systems: no magic bullets. *Am J Prev Med.* 2002;23:70–71
61. Szilagyi PG, Humiston SG, Shone LP, Barth R, Kolasa MS, Rodewald LE. Impact of vaccine financing on vaccinations delivered by health department clinics. *Am J Public Health.* 2000;90:739–745
62. Szilagyi PG, Humiston SG, Pollard Shone L, Kolasa MS, Rodewald LE. Decline in physician referrals to health department clinics for immunizations: the role of vaccine financing. *Am J Prev Med.* 2000;18:318–324
63. Szilagyi PG, Rodewald LE, Humiston SG, et al. Immunization practices of pediatricians and family physicians in the United States. *Pediatrics.* 1994;94:517–523
64. Zimmerman RK, Santibanez TA, Janosky JE, et al. What affects influenza vaccination rates among older patients? An analysis from inner-city, suburban, rural, and Veterans Affairs practices. *Am J Med.* 2003;114:31–38
65. Humiston SG, Szilagyi PG, Iwane MK, et al. The feasibility of universal influenza vaccination for infants and toddlers. *Arch Pediatr Adolesc Med.* 2004;158:867–874
66. Schaffer SJ, Bruno S. Varicella immunization practices and the factors that influence them. *Arch Pediatr Adolesc Med.* 1999;153:357–362
67. Kraus DM, Campbell MM, Marcinak JF. Evaluation of universal hepatitis B immunization practices of Illinois pediatricians. *Arch Pediatr Adolesc Med.* 1994;148:936–942
68. Ehresmann KR, Mills WA, Loewenson PR, Moore KA. Attitudes and practices regarding varicella vaccination among physicians in Minnesota: implications for public health and provider education. *Am J Public Health.* 2000;90:1917–1920
69. Zimet GD, Mays RM, Sturm LA, Ravert AA, Perkins SM, Juliar BE. Parental attitudes about sexually transmitted infection vaccination for their adolescent children. *Arch Pediatr Adolesc Med.* 2005;159:132–137

70. Szilagyi PG, Dick AW, Klein JD, Shone LP, Zwanziger J, McInerny T. Improved access and quality of care after enrollment in the New York State Children's Health Insurance Program (SCHIP). *Pediatrics.* 2004;113(5). Available at: www.pediatrics.org/cgi/content/full/113/5/e395
71. Wycoff A. AAP-AMA Immunization Congress draws up solutions to vaccine financing, access issues. *AAP News.* 2007;28:1–9
72. Shone LP, Szilagyi PG. The State Children's Health Insurance Program. *Curr Opin Pediatr.* 2005;17:764–772
73. Rodewald LE, Szilagyi PG, Holl J, Shone LR, Zwanziger J, Raubertas RF. Health insurance for low-income working families: effect on the provision of immunizations to preschool-age children. *Arch Pediatr Adolesc Med.* 1997;151:798–803
74. Smith PJ, Santoli JM, Chu SY, Ochoa DQ, Rodewald LE. The association between having a medical home and vaccination coverage among children eligible for the Vaccines for Children program. *Pediatrics.* 2005;116:130–139
75. Szilagyi P, Vann J, Bordley C, et al. Interventions aimed at improving immunization rates. *Cochrane Database Syst Rev.* 2002;(4):CD003941
76. Lindley MC, Boyer-Chu L, Fishbein DB. The role of schools in strengthening delivery of new adolescent vaccinations. *Pediatrics.* 2008;121:S46–S54
77. Horlick G, Shaw FE, Gorji M, et al. Delivering new vaccines to adolescents: the role of school-entry laws. *Pediatrics.* 2008;121:S79–S84
78. Jain N, Yusuf H, Wortley PM, Euler GL, Walton S, Stokley S. Factors associated with receiving hepatitis B vaccination among high-risk adults in the United States: an analysis of the National Health Interview Survey, 2000. *Fam Med.* 2004;36:480–486
79. Davis MM, Ndiaye SM, Freed GL, Clark SJ. One-year uptake of pneumococcal conjugate vaccine: a national survey of family physicians and pediatricians. *J Am Board Fam Pract.* 2003;16:363–371
80. Daley MF, Crane LA, Beaty BL, et al. Provider adoption of pneumococcal conjugate vaccine and the impact of vaccine shortages. *Ambul Pediatr.* 2005;5:157–164
81. Lieu TA, Finkelstein JA, Adams MM, et al. Pediatricians' views on financial barriers and values for pneumococcal vaccine for children. *Ambul Pediatr.* 2002;2:358–366

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