
Strategies to Sustain Success in Childhood Immunizations

**A Report of the
National Vaccine Advisory Committee**

January 13, 1998

EXECUTIVE SUMMARY

INTRODUCTION

In a previous National Vaccine Advisory Committee (NVAC) report, known as the Measles White Paper, the Committee reviewed the causes of the measles epidemic of the late 1980's and early 1990's and identified failure of the immunization delivery system as an important contributor. A blueprint for change was proposed to address deficiencies in the system. Thirteen recommendations were made and included recommendations for 1) improvement in the availability of immunizations, 2) improvement in the delivery of immunizations, 3) improvement in the ongoing monitoring of immunizations, and 4) a call for new knowledge to support system change.

This blueprint for change became the keystone for the Childhood Immunization Initiative (CII). Launched in 1993, the CII is a comprehensive effort to improve the quality and quantity of immunization services, reduce vaccine costs to parents, increase community participation, education and partnerships, improve systems to monitor diseases and immunizations, and improve vaccines and vaccine use. The CII set three goals for 1996: to reduce the number of cases of most vaccine-preventable diseases to zero, to increase the immunization levels of two-year-olds to 90% for the first and most critical vaccine doses, and to build a vaccine delivery system to maintain high coverage. The CII also set the goal that by the year 2000, the infrastructure should be complete and insure that at least 90% of children receive the full vaccine series.

In 1995, NVAC identified as a priority the need for a comprehensive review of the status of the immunization delivery system and interventions to improve immunization coverage of children. A Subcommittee on Immunization Coverage was appointed by the Chairman of NVAC to review these issues. Their report follows.

SUMMARY OF FINDINGS

Achievement of the 1996 CII goals

- The majority of the 1996 disease prevention goals were met or nearly met.
- The 1996 goal to increase immunization rates for critical doses has been met.
- A vaccine delivery system is being built and many parts of that system seem to serve children well, but a comprehensive, efficient system to insure that the 11,000 babies born in this country each day get ALL the vaccines that they need to protect them is still a work in progress.

Status of the Immunization Delivery System

Availability of Immunizations

- In 1994, The Vaccines for Children (VFC) Program was implemented enabling poor children to receive immunizations at their provider's office promoting primary care in a medical home. This broad-based entitlement program is currently operational in all 50 states with vaccine delivery to all participating provider sites, public and private, solo practitioner and multiple provider clinics in all but one state.
- Eighty-seven (87) states, territories, and cities receive Immunization Action Plan (IAP) funds through competitive proposals to provide solutions to immunization delivery system shortcomings such as inadequate clinic hours.
- Approximately one-half of traditional indemnity or fee-for-service private insurance plans include immunization benefits.
- Virtually all health maintenance organizations (HMOs) cover immunizations. The Health Plan Employer Data and Information Set (HEDIS), a standardized set of health plan performance measures used by many managed care organizations, includes immunization as a valuable, although limited, quality assessment measure.

- Twenty-six State governments have improved the availability of immunizations by enacting legislation mandating coverage of immunizations by regulated insurance plans. However, approximately 40% of the nation's employee health benefit plans are exempt from regulation under the federal Employee Retirement Income Security Act (ERISA).
- Medicaid reimbursement rates for vaccine administration have improved in most States compared with previous fee-for-service Medicaid rates.
- Community organizations are vital partners in efforts to improve immunization coverage.

Delivery of Immunizations

- Standards for Pediatric Immunization Practices developed to provide guidance for the rapid, efficient, and consumer-oriented provision of immunization services as part of comprehensive primary care were released in May 1992.
- Sixty percent of state WIC programs report having a formal policy to review immunization status of their clients. Formal state policies notwithstanding, 72% of local WIC agencies report that they actively assess immunization status, with the majority (74%) reviewing written records.
- State day care laws provide a mechanism for promoting preschool immunization. All states require that children in day care receive DTP/DTaP and polio vaccine; all states except Alaska and Wisconsin require Hib vaccine and all states except Iowa require measles vaccine. Twenty (20) states require immunization with hepatitis B vaccine (HBV).
- Head Start Program performance standards require ongoing monitoring of a child's health status to include assurance that each child is immunized in accordance with the latest CDC recommendations.

Monitoring Immunization Status

- The National Immunization Survey (NIS) is the primary means to measure national, state, and urban-area coverage levels and progress toward national coverage goals.
- The Immunization Supplement to the National Health Interview Survey (NHIS) provides the opportunity to investigate risk factors for underimmunization and to monitor changes in the immunization delivery infrastructure (through the provider record check).

New Knowledge About Barriers

- A powerful and persistent barrier to timely immunization is poverty and factors associated with poverty.
- Erroneous belief by the parent that their child is fully immunized is a barrier.
- Providers' beliefs about their practice immunization coverage and specific immunization practices in their offices are barriers.
- The cost of immunization services is a barrier that is probably mitigated through participation in the VFC Program and through referral to health department clinics.
- Parental and provider attitudes about immunizations are not barriers for the majority of underimmunized preschool children.
- There is insufficient evidence to determine the extent to which inability to access an immunization provider is a barrier.

New Knowledge About Interventions

- Interventions that have been found to be effective include: enhancement of immunization services in WIC clinics, use of reminders/recalls, provider-based tracking, and provider-based assessment of immunization rates with feedback.
- Efforts to reduce missed opportunities are potentially effective.
- There has been little evidence to show effectiveness of one-day immunization events or administration of immunizations at emergency room visits.

Keeping up with Change: Challenges for the Future

- *Vaccine Safety Datalink Support for a Comprehensive Immunization Program.*
The Vaccine Safety Datalink Project provides crucial support for the maintenance of high rates of immunization coverage. Providers and parents believe in the value of immunizations. The VSD Project provides the ongoing monitoring of vaccine safety to support their belief.
- *Development of New Vaccines and Changes to the Immunization Schedule.*
The past few years have seen remarkable developments in the formulation of new vaccines and the development of combination vaccines. Interventions that transcend specific changes to the schedule are important to adjust to a changing vaccine environment.
- *Changes in the Health Care Delivery System.*
Changes in the health care delivery system will continue to have an impact on the delivery of preventive services such as immunizations. Recommendations to sustain improvements in immunization coverage must be made in the context of this evolving system and an emerging public-private partnership.
- *Identifying Children at Risk for Underimmunization.*
The complete immunization of 77% of our two-year-old children is cause for encouragement, but 23% of these children are missing one or more vaccines to complete the series. The utility of large national surveys to identify those not served decreases as the group gets smaller while the ability of population-based registries to find children at risk becomes more valuable.
- *Potential of Information Technology.*
Technological advances in information systems provide a method to improve immunization receipt through the development of immunization registry and follow-up systems.

RECOMMENDATIONS

The NVAC makes the following recommendations to sustain success in immunization coverage. Development of the recommendations was guided by the knowledge gained about barriers and interventions as well as the overarching challenges for the future outlined above. Specific recommendations to accomplish each broad goal are included in the full report.

Financing

- All health insurance plans, including Employee Retirement Income Security Act (ERISA) self-insured plans, should offer first dollar coverage for childhood vaccines that are recommended in the harmonized immunization schedule endorsed by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP).
- Managed care organizations and managed Medicaid plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.
- Indemnity health and self-insured plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.
- The Vaccines for Children (VFC) program should be supported.

Provider Practices

- All immunization providers, public and private, should assess the immunization coverage levels of their patients annually.
- All immunization providers, public and private, should operate recall and reminder systems.

Monitoring

- Immunization registries involving both public and private providers should be developed in each State.
- The National Immunization Survey should be the primary means of evaluating the immunization delivery performance of the nation as well as the States and major urban areas, until immunization registries are fully functioning.
- Health Plan Employer Data and Information Set (HEDIS) measures on immunization, both private sector and Medicaid, should be used by all purchasers and plans.
- Evaluations of program performance as well as research into the most cost-effective strategies for achieving and sustaining high immunization coverage should be continued.
- Disease surveillance activities at the State and local levels are essential for the prevention of disease and warrant support with Federal and State immunization program funds.

Support for Communities and Families

- Parents should be supported in their efforts to immunize their children.
- Immunization programs should collaborate with Special Supplemental Nutrition Program for Women, Infants and Children (WIC) to assess the immunization status of each child enrolled in WIC and to refer underimmunized children to their provider.
- CDC and State and local immunization programs should focus resources on underimmunized populations at risk of vaccine-preventable disease.
- Citizen coalitions should be encouraged in State and local communities to advocate for improvement and maintenance of high immunization coverage levels.

INTRODUCTION AND PURPOSE OF THE REPORT

The National Vaccine Advisory Committee (NVAC) was chartered in 1988 to advise and make recommendations to the Director of the National Vaccine Program (NVP) on matters related to the prevention of infectious diseases through immunization and the prevention of adverse reactions to vaccines. The Committee is appointed by the Director of NVP and is composed of 15 members from public and private organizations representing vaccine manufacturers, physicians, parents, and state and local health agencies and public health organizations (Appendix A). In addition, representatives from governmental agencies involved in health care or allied services serve as ex-officio members of the Committee.

The Committee identified as a priority the need for a comprehensive review of the status of the immunization delivery system and interventions to improve immunization coverage of children. A Subcommittee on Immunization Coverage was appointed by the Chairman of NVAC to review these issues.

This report addresses issues of childhood immunization only. The Committee acknowledges the need for periodic review of the different but related challenges associated with adult immunizations as was published in 1994.¹

METHODOLOGY

The Subcommittee met regularly from 1995 to 1997. Presentations on immunization programs, strategies, and financing were made to the Subcommittee by representatives from the National Immunization Program, other federal, state, and local agencies, professional organizations, insurers, businesses, and public and private health care providers (Appendix B). Evidence from the published literature was reviewed to further inform the discussions. Conclusions and recommendations in this report were reached by consensus process among the members of the Subcommittee and submitted to the full Committee for review, comment and approval.

BACKGROUND

Numerous NVAC reports have served as guidelines for the development and implementation of immunization policies and programs. Most relevant to this report was the NVAC paper written in response to the measles epidemic of 1989-91.² In that report, known as the Measles White Paper, the Committee reviewed the causes of the measles epidemic and identified failure of the immunization delivery system as an important contributor. A blueprint for change was proposed to address deficiencies in the system. The thirteen recommendations made included 1) improvement in the availability of immunizations, 2) improvement in the delivery of immunizations, 3) improvement in the ongoing monitoring of immunizations, and 4) a call for new knowledge to support system change.

This blueprint for change became the keystone for the Childhood Immunization Initiative (CII). Launched in 1993, the CII is a comprehensive effort to improve the quality and quantity of immunization services; reduce vaccine costs to parents; increase community participation, education and partnerships; improve systems to monitor diseases and immunizations; and improve vaccines and vaccine use.³ The CII set three goals for 1996: to reduce the number of cases of most vaccine-preventable diseases to zero, to increase the immunization levels of two-year-olds to 90% for the first and most critical vaccine doses, and to build a vaccine delivery system to maintain high coverage. The CII also set the goal that by the year 2000, the infrastructure should be complete and insure that at least 90% of children receive the full vaccine series.

CURRENT IMMUNIZATION STATUS OF THE NATION'S TWO-YEAR-OLDS

The majority of the 1996 disease prevention goals were met or nearly met. In 1996, no cases of polio caused by wild poliovirus and no cases of tetanus among children under 15 years of age were reported.⁴ The number of mumps cases was well below the target of 1600 cases.⁴ Reported cases of rubella, diphtheria, and invasive *Haemophilus influenzae* type b (Hib) disease

among children under five years of age, were at or near the lowest levels ever recorded.⁴ Measles cases were down to 433 indigenously acquired cases from more than 27,000 cases reported at the height of the epidemic in 1990.⁴

The 1996 goal to increase immunization rates for critical doses has been met. More than 90% of the nation's children aged 19 to 35 months did receive the first and most critical doses in the primary series.⁵ However, only 77% had received the primary immunizations series of four doses of diphtheria and tetanus toxoids and pertussis vaccine (DTP), three doses of poliovirus vaccine, one dose of any measles-containing vaccine (MCV), and three doses of *Haemophilus influenzae* type b (Hib) vaccine, commonly known as the 4:3:1:3 series.⁵ Approximately one million two-year-old children still need one or more doses of vaccine to be fully immunized. The Nation has demonstrated its ability to respond to the needs of its youngest citizens. To guard against complacency, efforts to meet the third goal of the CII, development of a sustainable vaccine delivery system need to be reinforced.

CURRENT STATE OF THE IMMUNIZATION DELIVERY SYSTEM

The third 1996 CII goal was to build an immunization delivery system to maintain high immunization coverage. What should the immunization delivery system look like in order to address the challenges and opportunities of childhood immunization? First, vaccinations should be delivered in the context of a medical home for comprehensive primary care; referral for routine vaccination from the medical home because of vaccine cost or availability should not be necessary; a link between every child and a primary care provider implies accountability for vaccination; and changing primary care providers should imply a hand-off of responsibility, accountability, and information (vaccination histories). Second, providers should practice in accordance with the Standards for Pediatric Immunization Practices and make available to their patients all of the universally-recommended vaccines. And, finally, an information system should exist that 1) monitors vaccination coverage levels among defined groups, such as provider patient panels and communities, 2) supports recall/reminder systems, 3) identifies children in need of vaccination at all provider and assessment sites, 4) supports disease surveillance and monitoring of vaccine adverse events and, 5) facilitates dissemination of new vaccine recommendations to immunization providers.

Improved immunization rates have resulted from efforts on the part of local, state and federal public and private organizations to develop such an immunization delivery system. Many of these efforts are described below. It is not possible to attribute national coverage increases to specific interventions because many communities conducted several interventions simultaneously, and because "real world" implementation of evidence-based interventions frequently differed from the published "laboratory" versions. However, these interventions can be linked in a general way to coverage increases because 1) strong evidence supporting their efficacy exists and 2) the interventions were programmatically implemented. A system is being built and many parts of that system seem to serve children well; but a comprehensive, efficient system to insure that the 11,000 babies born in this country each day get ALL the vaccines that they need to protect them is still a work in progress.

Immunizations are only one part of comprehensive child health care. Underimmunization has been shown to be a marker for inadequate child health supervision. Underimmunized children are less likely to have been screened for lead,⁶ tuberculosis,^{6,7} and anemia.⁷ Policies and interventions that enhance not only the receipt of immunizations but the receipt of the full complement of preventive child health services should be pursued.

Improvements in the Availability of Immunizations

1. Role of Federal and State Initiatives

In 1994, The Vaccines for Children (VFC) Program was implemented as part of the Childhood Immunization Initiative (CII). This federal vaccine program pays for and distributes vaccine to public and private providers for their Medicaid patients, uninsured patients, Native American and Alaskan Native patients, and, in some cases, patients whose private health insurance does not cover immunizations. This enables poor children to receive immunizations at their provider's office promoting primary care in a medical home. This broad-based entitlement program is currently operational in all 50 states with vaccine delivery to all participating provider sites including public and private, solo practitioner and multiple provider clinics in all but one state (CDC, unpublished data, December 1997). More than 45,000 provider sites had enrolled in the program as of October 1997. Seventy-four percent (74%) of enrolled sites are in the private sector. Participating provider sites may employ multiple physicians so the number of individual providers participating in the VFC Program is actually higher. Immunizations covered by the program are determined by the recommendations of the Advisory Committee on Immunization Practices (ACIP) thus streamlining the addition of new vaccines to the program.

In 1991, six community-based Immunization Action Plan (IAP) demonstration projects were developed in response to recommendations made in the Measles White Paper.² With these projects serving as models, CDC expanded the IAP program nationwide in 1992. Eighty-seven (87) states, territories, and cities were eligible for funds through competitive proposals. Initial funds were awarded to each area based on their preschool population with additional funds awarded to 51 projects based on the merit of their proposals. These funds augment but do not replace established funding for vaccine and immunization program administration. IAP funds are intended to be used to provide solutions to system shortcomings such as inadequate clinic hours and may also be used for other improvements in immunization service delivery, education and information for parents, and assessment of immunization status to assist program planning. Applicants are encouraged to submit innovative state or local initiatives targeted at the population most in need. Subsequent funds have been available to sustain these efforts and include additional incentive funds based on improvement in immunization rates as measured by the National Immunization Survey. The National Immunization Conference and an annual State Immunization Managers' meeting allow for the dissemination of experience and results of IAP efforts among immunization providers.

2. Role of Private Insurers

Private insurers play a key role in the promotion of adequate immunization. Fifty-four percent (54%) of infants and 62% of children one through five years of age are covered by private health insurance.⁸

Approximately one-half of traditional indemnity or fee-for-service private insurance plans include immunization benefits.⁹ It has been suggested that the increased cost of inclusion of immunizations in a family's standard benefits package may be a barrier to improving insurance benefits for children covered by traditional indemnity insurance. However, Actuarial Research Corporation estimates that without cost sharing, adding coverage for all currently recommended childhood vaccines to the health benefit plan of employees in a 500-employee company would increase insurance costs for a family package by \$2.37 per month.¹⁰ With cost sharing in the form of deductibles or co-payments, the additional cost of immunization coverage could be as low as \$1.56.¹⁰ The addition of new and possibly costly vaccines to existing immunization benefits has also been cited as an impediment to insurance coverage of vaccines. One major insurer determined that the cost of adding Varicella vaccine to its benefit package was not sufficient to warrant an increase in premiums.¹¹ Considering the potential savings from claims for care of complications from Varicella prevented by the vaccine, the costs of covering the vaccine may be even less.¹¹

Virtually all health maintenance organizations (HMOs) cover immunizations.⁹ The role of managed care in promoting immunizations is critical as the number of people who receive health

care in HMOs has increased from six million in 1976 to an estimated 56 million in 1995.¹² HMO enrollees include over 13 million Medicaid beneficiaries.¹³ Managed care organizations are also important in immunization surveillance. The Health Plan Employer Data and Information Set (HEDIS), a standardized set of health plan performance measures, includes immunization as an important quality assessment measure although strict eligibility criteria for HEDIS measures limit their ability to produce an accurate picture of the immunization status of all children served by each organization.¹⁴

State governments have improved the availability of immunizations by enacting legislation mandating coverage of immunizations by regulated insurance plans. Twenty-six states have insurance mandates in place (Appendix C).¹⁵ These laws cover only those insurance plans that are regulated by the state. Approximately 40% of the nation's employee health benefit plans are exempt from regulation under the federal Employee Retirement Income Security Act (ERISA).¹⁶ However, employers who self-fund their insurance plans and are exempt from regulation under ERISA may be influenced by state mandates. One-quarter of self-funded employers surveyed in Pennsylvania added immunization benefits to their health plans after a state law mandating coverage was passed; one-half of them cited the mandate as influencing them to expand coverage.¹⁷

One-third of infants and 29% of children ages one through five are Medicaid enrollees.⁸ Providers who refer Medicaid patients to local health departments for immunizations have cited inadequate Medicaid reimbursement as a factor in their decision to refer.¹⁸⁻¹⁹ The VFC Program addressed a large part of this problem by providing public-purchase vaccine to Medicaid providers at no cost. In addition, reimbursement rates for administration have improved in most States compared with previous fee-for-service Medicaid rates (CDC, unpublished data, April 1997).

3. Role of the Community

Community organizations are vital partners in efforts to improve immunization coverage. In Jacksonville, Florida, public and private providers were joined by a university computer science department, the Kiwanis Club, and private corporations and citizens to implement a multifaceted program to improve immunizations.²⁰ An immunization van was obtained and a "fast track" immunization clinic was opened. The Shots by Two Program uses volunteers who "adopt" newborns and provide support for families by sending a card of congratulations to the new parent, a birthday card on the infant's first birthday, and immunization reminders at appropriate intervals. Through this and other efforts of this community, the immunization rate of local two-year-olds increased from 64% to 81%. In Dallas, Texas, a partnership between the City Health Department, Mattel Corporation, Texas Women's University and retired senior volunteers from the Urban League has been developed to identify children at risk for underimmunization and provide services to them.²¹ Volunteers will survey the population to determine low immunization coverage census tracts. Using a mobile van partially funded by their corporate partner, Mattel, Health Department nurses and University faculty and students will provide immunization services to children in those areas.

Improvement in Delivery of Immunizations

Standards for Pediatric Immunization Practices were released in May 1992 and were widely promulgated in the medical and public health literature.²²⁻²⁴ The 18 standards were developed to provide guidance for the rapid, efficient, and consumer-oriented provision of immunization services as part of comprehensive primary care. Assessment of immunization practices before the release of the standards revealed adherence to some standards that ranged from nearly universal for the standard requiring parental education (standard 5) to rare for the standard requiring simultaneous administration of all vaccines when a child is first eligible (standard 8) with considerable within- and between-practice variability.²⁵ In a prospective comparison of two public health clinics, there was a 40% improvement in immunization rates for children served at a clinic that had systematically implemented the standards compared to a control clinic where the standards

prevent.³⁷ Belief that the timing of immunizations is not important was the only attitude that was consistently associated with late receipt of immunizations.³⁷ Although specific provider practices may impede the delivery of immunizations, provider attitudes and beliefs about immunizations have not been shown to be a barrier. In a study of Minnesota physicians, almost all respondents believed vaccine efficacy to be high and the risk from vaccines to be low.⁶⁵

Inadequate Evidence to Assess

There is insufficient evidence to determine the extent to which inability to access an immunization provider is a barrier. The study of referral patterns of physicians after implementation of the VFC program cited above⁶⁴ provides evidence for increased access to immunization services for poor children in their medical home. It does not provide information on change in the number of providers who now offer immunization services when they offered none before. Access is also more complex than simply being able to identify a provider who gives immunizations. In an insured employed population, 98.5% of parents reported that their child had a provider, however problems getting an appointment was a predictor of underimmunization.⁴³ Similar problems with ability to get to the provider's office, e.g., transportation, appointment times, and problems with child care, have been reported by poor mothers.³⁸

NEW KNOWLEDGE ABOUT INTERVENTIONS

In addition to new knowledge about barriers, new knowledge has been gained about immunization interventions that work and those that do not (Table 2). Interventions that have been found to be effective include: enhancement of immunization services in WIC clinics,⁶⁶⁻⁶⁷ use of reminders/recalls,⁶⁸⁻⁷² provider-based tracking,⁷³ and provider-based assessment of immunization rates with feedback.⁷⁴⁻⁷⁷ Efforts to reduce missed opportunities are potentially effective.⁶⁰ There has been little evidence to show effectiveness of one-day immunization events⁷⁸⁻⁷⁹ or administration of immunizations at emergency room visits.⁸⁰⁻⁸³

Successful Interventions

1. Linkages with WIC

Interventions to improve immunization status were tested in a randomized trial in six New York City WIC sites.⁶⁷ Sites were randomized to one of three interventions to be implemented when a child's immunizations were not up-to-date: a nurse escorted the child to a nearby clinic for immunizations that day, clients were required to return for vouchers monthly until immunizations were up-to-date, or clients were referred for immunization services. At baseline, 14% of children from all six sites combined were considered to be eligible for the measles vaccine. At the end of the intervention, 86% of these vaccine-eligible children at escort sites had received measles vaccine compared to 79% of children at voucher incentive sites and 54% of children at referral sites. In a second WIC intervention trial in Chicago, linking receipt of WIC vouchers to assessment of immunization status and referral for needed immunizations led to a 36% to 40% increased prevalence of up-to-date status compared to a 4% increase for a control group.⁶⁶

2. Reminders and Recalls

Reminders sent before appointments and/or immunizations are due that prompt the parent to make or keep an appointment and recall notices sent when immunizations have been missed are effective strategies to improve immunization compliance. Reminders have resulted in better kept appointment rates for clients in public clinics,⁶⁸ hospital clinics,⁶⁹ and in a university-based primary care practice.⁷⁰ They have been effective for immunization visits,⁷¹⁻⁷² health supervision visits,⁷⁰ and other visits,⁷⁰ and for children of low and high socioeconomic status.⁷⁰ Both general reminders (those that give date and time of appointment) and specific reminders (those that give detailed information about the visit) have been shown to be effective.^{69,71} Recall notices may have

more of an impact on the receipt of unscheduled immunizations than reminder notices.⁷¹ Reminders delivered by automated dialing technology can be less expensive than mailed reminders,^{68,71} but mailed reminders may be cost-effective in settings where missed appointments result in lost revenue.⁶⁹⁻⁷⁰ Autodialer messages have been received positively by parents.⁷¹ The value of autodialers is limited for providers serving a poor population where telephones are not always available.

3. Assessment of Provider Practices

Provider immunization assessment is a valuable tool for determining immunization coverage levels and provider practices associated with low levels of coverage. A key component of provider assessment is the provision of ranked feedback to providers to allow them to assess their performance relative to their peers. The Georgia Department of Public Health has assessed immunization coverage in all of its clinics since 1986.⁷⁴ Immunization rates increased from 35% in 1987 to 80% by 1993 with a concomitant decrease in missed opportunities at the last visit from 15% to 1%.⁷⁵ Similar improvements have been demonstrated in other public health care sites⁷⁶ and private practices.⁷⁷ To facilitate provider assessments, CDC developed the Clinic Assessment Software Application (CASA).⁸⁴ CASA enables providers to perform on-site immunization audits from medical records and produces immediate immunization rates for review. CASA is a public domain tool (<http://www.cdc.gov/nip/casa>) that may be used as part of the Assessment, Feedback, Incentives, and Information eXchange (AFIX) program developed by CDC to assist providers in examining their own immunization policies and practices.

Successful interventions rely on the ability to obtain complete immunization histories, whether it is to determine the immunization status of a child who presents for care in the provider's office, to refer a child who has come for other services such as WIC, to send reminders/recalls to parents of children due or overdue for immunizations, or to examine broader issues of practice or program performance. Provider-based immunization information systems provide that essential support for immunization practices.⁸⁵ The immunization tracking system in place in the Northern California Kaiser Permanente system demonstrates the multiple uses of a provider-based system.⁷³ The tracking system, in which more than 97% of immunizations given in the Kaiser system are recorded, is used to assess an individual child's immunization status at the point of service and to provide an immunization report for parents. In addition, the database is used to examine service delivery issues such as immunization delay and to evaluate interventions. Provider-based tracking systems are valuable only when there is little movement of patients in and out of the system or assiduous effort is made to obtain and enter information on immunizations given elsewhere.

Potentially Effective Interventions

Although reduction of missed opportunities for nonsimultaneous administration of vaccines in public clinics has been demonstrated,⁷⁴ there is little evidence to assess the effect of interventions targeted at reducing missed opportunities at acute care visits. A program to reduce missed opportunities at any visit by screening all charts and attaching immunization reminder cards to them resulted in no greater immunizations rate for the intervention group compared to controls.⁶⁰ However, only one-third of charts for children in the intervention group were actually screened and flagged underscoring the difficulty in changing routines in a busy primary care practice. Further study is needed to identify more effective means to reduce missed opportunities, particularly in settings where children receive only intermittent care.

Interventions with Limited Effectiveness

Other interventions show less evidence of impact. One-time events, such as immunization days at shopping malls or immunization "fairs" have not proven to be cost-effective strategies for improving immunization levels. Turnout at a New York City "Immunization Day" was disappointing and the overall \$279 cost per immunization given was high.⁷⁸ In Kansas, a weekend immunization campaign reached only a small portion of the target population, underimmunized

children less than 24 months of age.⁷⁹ The number of those receiving immunizations during the first campaign who remained up-to-date was also disappointing. Such campaigns serve to fragment care between immunizations and health supervision and further separate children from a primary care provider. They may be valuable, however, in the public emphasis that they give to immunizations and they may be a popular way to enlist the support of community businesses or other organizations.

The Standards for Pediatric Immunization Practices highlighted the need to immunize children at every clinical encounter.²² Many children seen at emergency departments are eligible for vaccines but vaccines have been given infrequently in this setting.⁸⁰ Immunization in emergency departments presents logistical problems in determining if a child needs immunizations and which ones s/he needs.⁸¹⁻⁸³ Even when immunizations are given in the emergency department as part of programs emphasizing the provision of immunizations in that setting, subsequent immunization rates among those children have been no higher than those for children who were not immunized in the emergency department.⁸³

KEEPING UP WITH CHANGE: CHALLENGES FOR THE FUTURE

Vaccine Safety Datalink Support for a Comprehensive Immunization Program

The Vaccine Safety Datalink (VSD) Project was established to fill the gaps in knowledge about vaccine-associated adverse events.⁸⁶ This collaborative effort between researchers at the CDC and participating health maintenance organizations allows examination of the association between vaccine administration and 34 medical outcomes using a large sample of children who have received immunizations at participating sites. The research made possible by this cooperative venture is not limited to children. A recent study conducted by the VSD team and researchers at Kaiser Permanente found no increased risk for new onset chronic arthropathies or neurologic conditions in women receiving the RA 27/3 rubella vaccine.⁸⁷ The Vaccine Safety Datalink Project provides crucial support for the maintenance of high rates of immunization coverage by raising confidence that risks associated with vaccines can be detected and defined. Providers and parents believe in the value of immunizations. The VSD Project provides the ongoing monitoring of vaccine safety to support their belief.

Development of New Vaccines and Changes to the Immunization Schedule

The past few years have seen remarkable developments in the formulation of new vaccines and the development of combination vaccines. Since 1991, seven changes have been made to the recommended immunization schedule including the addition of new vaccines, newly formulated vaccines, and combination vaccines as well as changes to the schedule for existing vaccines. More changes to this already complex schedule can be anticipated. Dissemination of information to providers and parents regarding new vaccines and changes to the schedule will remain essential to the maintenance of current immunization rates. A harmonized schedule developed in 1995 and jointly endorsed by the ACIP, American Academy of Pediatrics (AAP) and American Academy of Family Physicians (AAFP) can reduce confusion among providers. Interventions that transcend specific changes to the schedule are important to adjust to a changing vaccine environment.

Changes in the Health Care Delivery System

Changes in the health care delivery system will continue to have an impact on the delivery of preventive services such as immunizations. Vaccines for Children Program has promoted the return of children to their primary providers for comprehensive health care. An increasing portion of Americans receive their care in managed care settings. More and more children with publicly-funded care are being cared for in the private sector by managed care providers. Public health services are being privatized in some areas. **Recommendations to sustain improvements in immunization coverage must be made in the context of an emerging public-private partnership.**

Identifying Children at Risk for Underimmunization

The complete immunization of 77% of our two-year-old children for the 4:3:1:3 series is cause for encouragement, but 23% of these children are missing one or more vaccines to complete the series. The more children we successfully protect, the harder it will be to identify those still at risk who are likely to be clustered in pockets of need. The utility of large national surveys to identify those not served decreases as the group gets smaller while the ability of population-based registries to find children at risk becomes more valuable. Interventions to serve these most hard-to-reach children should be developed in partnership with community leaders to assure that they are culturally sensitive. Evaluation of the impact of these strategies is essential, as it is for all interventions, to insure that targeted efforts reach those in need.

Potential of Information Technology

Technological advances in information systems provide a method to improve immunization receipt through the development of immunization registry and follow-up systems. The National Vaccine Advisory Committee supports the development of a national immunization information system⁸⁸ and it will revisit this issue in the coming year. Registry development is currently being supported by the CDC, the Robert Wood Johnson Foundation, the Annie E. Casey Foundation, the Skillman Foundation, the California Wellness Foundation, and the David and Lucille Packard Foundation. Population-based systems support completion of the primary immunization series at the individual level by notifying parents when their child is due or overdue for an immunization and by enabling providers to obtain the immunization history for a child in their care, to update that history, and to provide that history to another health care provider to whom a child's care has been transferred. Immunization registries can provide aggregate data to health care managers to determine practice immunization rates for use in quality assurance assessment and to immunization program planners to identify pockets of children who are underserved to target appropriate interventions. Data collected by these registries can further be used to evaluate the success of general and specific immunization efforts. The successful implementation of birth certificate-based registries will allow states and local jurisdictions to obtain the population-specific small area immunization rates not possible from the NIS and Immunization Supplement to the NHIS. Development of comprehensive immunization registry and follow-up systems will have significant costs. Just as a public-private partnership for the provision and use of immunization information is essential to the successful implementation of registry systems, a public-private partnership is important as well for the financial support of system development and maintenance.

RECOMMENDATIONS

The NVAC makes the following recommendations to sustain success in immunization coverage. Development of the recommendations was guided by the knowledge gained about barriers and interventions as well as the overarching challenges for the future outlined above.

FINANCING

All health insurance plans, including Employee Retirement Income Security Act (ERISA) self-insured plans, should offer first dollar coverage for childhood vaccines that are recommended in the harmonized immunization schedule endorsed by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP).

- First dollar coverage should include adequate reimbursement for both vaccine and administration.
- All States should require, through law or regulation, first dollar coverage for immunizations.
- The Centers for Disease Control and Prevention (CDC) should review and circulate model legislation and regulations.
- Congress should enact legislation to require first dollar coverage for ERISA self-insured plans.
- All employers should ensure the health plans they offer to employees and their families include comprehensive childhood immunization coverage.

Managed care organizations and managed Medicaid plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.

- State health department immunization program leadership should take an active role in setting the immunization standards and negotiating the state's contracts for Medicaid managed care.
- CDC should circulate to States and employers model managed care legislation, licensure requirements, and contract language that address the provision of immunization services.
- Managed care organizations should use effective strategies to improve and maintain immunization coverage levels of their members. These strategies might include recall and/or reminder systems, practice-based coverage assessments, and provider incentives and education.

Indemnity health and self-insured plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.

- All packages offered by indemnity and self-insured health plans should include immunization benefits.
- Plans should use billing or encounter data to evaluate coverage levels of insured children and recall those in need of immunization.
- Plans should disseminate information for the improvement of immunization practices, including schedule changes, to participating child health providers.
- Plans should use effective strategies to improve immunization coverage levels of their members. These strategies might include recall and/or reminder systems, practice-based coverage assessments, and provider incentives and education.

The Vaccines for Children (VFC) program should be supported.

- States should work to increase provider enrollment.
- State Medicaid programs should encourage all Medicaid-enrolled providers that immunize children to participate in the VFC program.
- State and local immunization programs should work with their respective chapters of AAP, AAFP, and other provider groups to recruit their members into the VFC program.
- States should assure that all vaccines as recommended by the ACIP are available to all VFC-eligible children.

PROVIDER PRACTICES

All immunization providers, public and private, should assess the immunization coverage levels of their patients annually.

- State and local health departments should assure that all public clinics are assessed.
- Private providers should assess their practices with the available support and assistance from State and local health departments, professional associations, and managed care organizations and other insurers.

All immunization providers, public and private, should operate recall and reminder systems.

- CDC should develop a clearinghouse for the collection and dissemination of model recall and reminder systems.
- CDC should work with the AAP, AAFP, and other professional organizations to promote routine use of recall and reminder systems among their membership.
- State and local health departments should support the development and coordination of, as well as provider participation in, recall and reminder systems.

MONITORING

Immunization registries involving both public and private providers should be developed in each State.

- CDC should conduct evaluations to monitor the status of registry development and to facilitate registry implementation, including private sector participation, through the identification of critical needs, best practices, and legal barriers.
- A stable funding mechanism for immunization registries needs to be developed that combines resources from the Federal government, State/local governments, and the private sector.
- The use of immunization registries to assist in the monitoring of adverse events and efficacy of the recommended vaccines should be explored.
- Immunization registries should be developed with the capabilities of identifying underimmunized populations at risk for vaccine-preventable diseases and supporting interventions that improve coverage levels.

The National Immunization Survey should be the primary means of evaluating the immunization delivery performance of the nation as well as the States and major urban areas, until immunization registries are fully functioning.

Health Plan Employer Data and Information Set (HEDIS) measures on immunization, both private sector and Medicaid, should be used by all purchasers and plans.

- HEDIS measures for evaluation of immunization coverage should continue to be updated and improved to better reflect actual coverage levels.

Evaluations of program performance as well as research into the most cost-effective strategies for achieving and sustaining high immunization coverage should be continued.

- Methods should be developed to monitor and evaluate the effectiveness of the changing health care system on immunization delivery.
- Integration of the delivery of immunizations into comprehensive primary care should be encouraged and evaluated to assess impact on overall child health and health care.
- Innovative State and local strategies to improve immunization coverage and efficiency of delivery should be evaluated.
- The safety as well as efficacy of current and new vaccines should continue to be evaluated.

Disease surveillance activities at the State and local levels are essential for the prevention of disease and warrant support with Federal and State immunization program funds.

- Laboratories have an essential role in surveillance, case investigation, outbreak control and disease elimination. Laboratory capacity must be developed, maintained and readily accessible to State and local public health officials.
- The quality of surveillance activities should be routinely monitored, and continuous efforts made to improve surveillance and case investigation.
- States should comply with accepted indicators of surveillance quality and furnish that information to the CDC.
- Training of local health department personnel responsible for surveillance, case investigation, and outbreak control activities is essential and should be supported by immunization program funds.

SUPPORT FOR COMMUNITIES AND FAMILIES

Parents should be supported in their efforts to immunize their children

- Public awareness campaigns to improve parents' knowledge about the importance of immunizations should be sustained and/or initiated, particularly in underserved areas.
- Providers and third-party payers should inform and remind parents about the current harmonized immunization schedule.
- Outreach, through telephone, mail, and home visits, should be used to connect hard-to-reach families to well-child services, particularly immunizations.

Immunization programs should collaborate with Special Supplemental Nutrition Program for Women, Infants and Children (WIC) to assess the immunization status of each child enrolled in WIC and to refer underimmunized children to their provider.

- WIC clinics serving areas at greatest risk of vaccine-preventable diseases, especially those in underserved populations, should be the highest priority.
- Immunization programs should share the cost of assessing the immunization status of WIC participants.
- Co-locating clinics and co-scheduling of appointments among WIC, immunization services, and comprehensive child health care ("one-stop shopping") should be encouraged.

CDC and State and local immunization programs should focus resources on underimmunized populations at risk of vaccine-preventable disease.

- Resources should be concentrated on activities that improve immunization coverage for populations who are at risk for underimmunization.
- CDC should work with the States to explore innovative methods for enhancing performance and assuring accountability for the resources devoted to populations at risk for underimmunization.
- CDC should continue to work with State and local health departments to identify high risk populations, activities that are likely to be most effective at improving and sustaining high coverage levels, and methods to evaluate the impact of the activities.

Citizen coalitions should be encouraged in State and local communities to advocate for improvement and maintenance of high immunization coverage levels.

Table 1. —Barriers to Immunizations

Critical Barriers to Immunization

Poverty and correlates of poverty such as family size, maternal education, and maternal age³³⁻³⁷
Factors associated with poverty such as lack of transportation, lack of child care³⁸
Parental lack of knowledge that immunizations are due^{35,43-44}
Parents' inaccurate belief that their children's immunizations are up-to-date⁴⁰⁻⁴¹
Providers' inaccurate belief that their patients' immunizations are up-to-date^{7,42}
Lacking of tracking systems in providers' offices⁴⁶⁻⁴⁷
Inadequate or inaccurate assessment of immunization status at each clinical encounter^{47,50-53}
Failure to provide all indicated vaccines at health care visits^{47,54}
Cost of immunizations and lack of insurance coverage^{47,54,61-63}

Little Evidence of Barriers

Parents' attitude and beliefs about immunizations³⁷
Providers' attitude and beliefs about immunizations⁶⁵

Inadequate Evidence to Assess

Ability to access an immunization provider⁴³

Table 2. —Interventions to Improve Immunization Status

Successful Interventions

Linkage of WIC services with immunization services⁶⁶⁻⁶⁷
Recalls for immunizations missed and reminders for immunizations⁶⁸⁻⁷²
Assessment of providers' immunizations rates with feedback⁷⁴⁻⁷⁷

Potentially Effective Interventions

Programs to reduce missed opportunities⁶⁰

Interventions with Limited Effectiveness

One-day immunization events⁷⁸⁻⁷⁹
Provision of immunizations at emergency department visits⁸⁰⁻⁸³

Table 3.—Recommendations

RECOMMENDATIONS TO SUSTAIN SUCCESS IN IMMUNIZATION COVERAGE
FINANCING
<ul style="list-style-type: none">• All health insurance plans, including Employee Retirement Income Security Act (ERISA) self-insured plans, should offer first dollar coverage for childhood vaccines that are recommended in the harmonized immunization schedule endorsed by the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP).• Managed care organizations and managed Medicaid plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.• Indemnity health and self-insured plans should ensure complete immunization of their members using the current harmonized schedule endorsed by ACIP, AAP, and AAFP.• The Vaccines for Children (VFC) program should be supported.
PROVIDER PRACTICES
<ul style="list-style-type: none">• All immunization providers, public and private, should assess the immunization coverage levels of their patients annually.• All immunization providers, public and private, should operate recall and reminder systems.
MONITORING
<ul style="list-style-type: none">• Immunization registries involving both public and private providers should be developed in each State.• The National Immunization Survey should be the primary means of evaluating the immunization delivery performance of the nation as well as the States and major urban areas, until immunization registries are fully functioning.• Health Plan Employer Data and Information Set (HEDIS) measures on immunization, both private sector and Medicaid, should be used by all purchasers and plans.• Evaluations of program performance as well as research into the most cost-effective strategies for achieving and sustaining high immunization coverage should be continued.• Disease surveillance activities at the State and local levels are essential for the prevention of disease and warrant support with Federal and State immunization program funds.
SUPPORT FOR COMMUNITIES AND FAMILIES
<ul style="list-style-type: none">• Parents should be supported in their efforts to immunize their children.• Immunization programs should collaborate with Special Supplemental Nutrition Program for Women, Infants and Children (WIC) to assess the immunization status of each child enrolled in WIC and to refer underimmunized children to their provider.• CDC and State and local immunization programs should focus resources on underimmunized populations at risk of vaccine-preventable disease.• Citizen coalitions should be encouraged in State and local communities to advocate for improvement and maintenance of high immunization coverage levels.

Appendix A

National Vaccine Advisory Committee January 1998

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Appendix A - continued

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Appendix B
Speakers at Immunization Coverage Subcommittee

September 28, 1995

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Edmond Maes, PhD, National Immunization Program, Centers for Disease Control and Prevention, Atlanta, GA
Elizabeth Zell, MStat, National Immunization Program, Centers for Disease Control and Prevention, Atlanta, GA

March 18, 1996

Steve Sepe, National Vaccine Program Office, Centers for Disease Control and Prevention, Atlanta, GA
Chester Robinson, DPA, Health Care Financing Administration, Department of Health and Human Services, Washington, DC
Jeff Totten, Mercer Management Consulting
Sam Flint, MD, American Academy of Pediatrics, Elk Grove Village, IL
Robert Hansen, Aetna Health Plans

March 19, 1996

Howard Bailet, Center for Health Policy Studies, University of Connecticut, and Sloan Center for Managed Care Research, Harvard University, Cambridge, MA
David Simmons, Polsinelli White Law Firm, Kansas City, MO
Ned Calonge, Kaiser Permanente
Charlie Pryde, Ford Motor Company
Constance Rothrock, South Carolina Electric and Gas
Martha King, National Conference of State Legislatures
Linda McCardle, Michigan Medicaid Program
Chris Grant, Partnership in Prevention

August 26, 1996

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Chris Koepke, Albert Einstein Medical Center, Philadelphia, PA
Lance Rodewald, MD, National Immunization Program, Centers for Disease Control and Prevention, Atlanta, GA

August 27, 1996

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Penny Borenstein, MD, Baltimore City Health Department, Baltimore, MD
Bob Levenson, Philadelphia Department of Health, Philadelphia, PA
Judy Rayman, InterCare Community Health Network, Bangor, MI
Steven Black, MD, Kaiser Permanente
Jim Tobin, MD, Genessee Health Services, Rochester, NY
Alan Kohrt, MD, Pediatric Practices of Northeastern Pennsylvania, Honesdale, PA
David Link, MD, Cambridge Hospital, Cambridge, MA

Appendix C

States with Legislation Mandating Insurance Coverage of Childhood Immunizations

Arkansas*	Missouri
California*	Montana*
Colorado*	Nebraska
Connecticut*	New Jersey
Florida*	New Mexico
Georgia*	New York*
Hawaii*	Ohio*
Iowa*	Oklahoma
Kansas	Pennsylvania
Louisiana	Rhode Island*
Maryland*	Texas
Massachusetts*	West Virginia
Minnesota*	District of Columbia*

*Legislation covers comprehensive preventive services for children including immunizations.

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