

Use of Selected Clinical Preventive Services to Improve the Health of Infants, Children, and Adolescents — United States, 1999–2011



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Foreword

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CDC has a long history of monitoring the use of clinical preventive services to provide public health agencies, health-care providers, health-care organizations, and their partners with information needed to plan and implement programs that increase use of these services and improve the health of the U.S. population. Increased use of clinical preventive services could improve the health of infants, children, and adolescents and promote healthy lifestyles that will enable them to achieve their full potential. The Affordable Care Act (ACA) expands insurance coverage, consumer protections, and access to care for the U.S. population and places a greater emphasis on prevention. Through implementation of ACA, new opportunities exist to promote and improve use of these valuable and vital services. This supplement provides a baseline assessment of the use of key services before ACA implementation.

Public health and clinical medicine complement each other and can achieve real synergies only with increased collaboration. Public health also can serve as an honest broker by providing unbiased and scientifically accurate information to providers, policy makers, the health-care community, and the public and is well equipped to monitor health systems to facilitate increases in effectiveness and efficiency.

This *MMWR* supplement is the second in a periodic series of reports examining use of selected clinical preventive services in the United States. Other important clinical preventive services for infants, children, and adolescents are not covered in this supplement (e.g., screening for obesity and screening and effective treatment of depression) because robust national data for these services were not available. For other important health problems among infants, children, and adolescents, including improper use of motor vehicle restraints and misuse of alcohol, no proven, recommended clinical preventive services exists, although there are effective community-level strategies that have potential for scale-up. The reports focus on the following services for infants, children, and adolescents:

- Breastfeeding counseling during the prenatal period;
 - During infancy:
 - screening for hearing loss and provision of follow-up services, and
 - screening for developmental delays starting in early infancy;
 - During early and middle childhood,
 - screening for lead poisoning,
 - screening for vision impairment,
 - screening for hypertension starting in early childhood, and
 - provision of dental services and preventive dental services starting in early childhood;
 - During adolescence:
 - vaccination against human papillomavirus,
 - screening for tobacco use and tobacco cessation counseling and medication use among current tobacco users,
 - screening for chlamydia infection among female adolescents, and
 - provision of reproductive health services.
- The findings in this supplement indicate that millions of infants, children, and adolescents in the United States have not benefitted from key clinical preventive services, and that there are large disparities by demographics, geography, and health-care coverage and access in the use of these services.
- One in six (17%) pregnant women did not receive breastfeeding counseling during prenatal care visits in 2010 (1).
 - Approximately 50% of infants who failed their hearing screening were not documented to have received testing needed to diagnose hearing loss during 2009–2010 (2).
 - Parents of approximately 80% of children aged 10–47 months were not asked by health-care providers to complete a formal screen for developmental delays during the preceding 12 months in 2007 (3).
 - Two thirds (67%) of children aged 1–2 years were not screened and reported to CDC for lead poisoning in 2010 (4).
 - According to their parents, approximately one in five (22%) children aged 5 years never had their vision checked by a doctor or other health-care provider during 2009–2010 (5).
 - Approximately one in four (24%) clinic visits for preventive care made by 3–17 year-olds to office-based physicians and hospital outpatient departments during 2009–2010 had no documentation of blood pressure measurement (6).
 - More than half (56%) of children and adolescents did not visit the dentist during the preceding year in 2009, and 86% of children and adolescents did not receive a dental sealant or a topical fluoride application during the preceding year in 2009. More than two thirds (69%) of 5–19 year-olds did not have a dental sealant during 2005–2010 (7).

- Nearly half (47%) of females aged 13–17 years had not received their recommended first dose of human papillomavirus vaccine in 2011, and almost two thirds (65%) had not received ≥ 3 doses required for series completion (8).
- Approximately one in three (31%) outpatient visits made by 11–21 year-olds to office-based physicians during 2004–2010 had no documentation of tobacco use status, and 80% of those who screened positive for tobacco use did not receive any cessation assistance including tobacco counseling and/or provision of cessation medication (9).
- Almost two thirds (60%) of sexually active females aged 15–21 years did not receive chlamydia screening during the preceding 12 months during 2006–2010 (10).
- Approximately one in four (24%) sexually experienced females aged 15–19 years and more than one in three (38%) sexually experienced males aged 15–19 years did not receive a reproductive health service from a health-care provider during the preceding 12 months during 2006–2010 (11).

Improved delivery and use of clinical preventive services during the prenatal period, infancy, and throughout childhood and adolescence can reduce illnesses, disorders, and disability among children and adolescents and can yield significant long-term benefits to help enable children to reach their full potential as healthy, productive adults.

This supplement documents the potential benefits of selected clinical preventive services for infants, children, and adolescents; the challenges related to their underuse; and effective collaborative strategies to improve use. The findings in these reports should help increase the use of these services and thereby enable infants, children, and adolescents in the United States live longer, healthier, and better quality lives.

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Rationale for Periodic Reporting on the Use of Selected Clinical Preventive Services to Improve the Health of Infants, Children, and Adolescents — United States

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Summary

This supplement is the second of a series of periodic reports from a CDC initiative to monitor and report on the use of a set of selected clinical preventive services in the U.S. population in the context of recent national initiatives to improve access to and use of such services. Increasing the use of these services can result in substantial reductions in the burden of illness, death, and disability and lower treatment costs. This supplement focuses on services to improve the health of U.S. infants, children, and adolescents. The majority of clinical preventive services for infants, children, and adolescents are provided by the health-care sector. Public health agencies play important roles in increasing the use of these services by identifying and implementing policies that are effective in increasing use of the services and by collaborating with stakeholders to conduct programs to improve use. Recent health-reform initiatives, including efforts to increase the accessibility and affordability of preventive services, fund community prevention programs, and improve the use of health information technologies, offer opportunities to improve use of preventive services. This supplement, which follows a previous report on adult services, provides baseline information on the use of a set of selected clinical preventive services to improve the health of infants, children, and adolescents before implementation of these recent initiatives and discusses opportunities to increase the use of such services. This information can help public health practitioners, in collaboration with other stakeholders that have key roles in improving infant, child, and adolescent health (e.g., parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations), understand the potential benefits of the recommended services, address the problem of underuse, and identify opportunities to apply effective strategies to improve use and foster accountability among stakeholders.

Introduction

Children have distinct health-care needs that are different than those of adults. They undergo rapid and constant physical, physiological, and developmental changes from infancy through adolescence. Their unique health needs in various life stages of development present different opportunities for health-care providers to offer clinical preventive services that can improve the health of infants, children, and adolescents and promote healthy lifestyles to increase the opportunity for all children to achieve their full potential.

During infancy, newborn bloodspot and hearing screenings and continuous developmental screening are vital for early detection of many chronic conditions, including some genetic disorders. Injury prevention and vaccination, two clinical preventive services that also occur during infancy and continue through adolescence, are important to protect against acute conditions that could lead to injury, illness, disability, and death.

During early and middle childhood, major chronic disease risk factors begin to emerge. Identification of these risk factors, including those associated with adult conditions (e.g., hypertension and hyperlipidemia), can help minimize

progression of diseases that might persist into adulthood and can protect children from adverse health outcomes later in life. Provision of clinical preventive services such as vision screening, lead screening, blood pressure screening, lipid screening, obesity screening, and oral health services, are crucial during this period.

During adolescence, provision of clinical reproductive health services, screening for risky behaviors (e.g., tobacco, alcohol, and drug use), identification of potential negative consequences of risky behaviors (e.g., sexually transmitted infections and unintended pregnancy), and provision of interventions to mitigate such outcomes are essential services that improve the health of adolescents. Instilling healthy behaviors in adolescents provides benefits as they enter adulthood and sets the course for a healthy next generation as they themselves become parents.

Early screening and prevention of diseases and disorders during critical stages of development are the fundamentals of clinical preventive services in infants, children, and adolescents. Because child health care relies on active participation by parents, guardians, or other adults, in addition to health-care providers and public health practitioners, the provision of clinical preventive services to children requires a coordinated effort. Because of the years of potential healthy life lost with inaction, intervening with clinical preventive services in childhood can yield substantial long-term benefits (1). Optimizing the use of available and effective clinical preventive services in childhood and adolescence is a public health priority (2–5), and it lays the groundwork for a healthy trajectory into adulthood (6,7).

Clinical Preventive Services

Preventive services delivered by health-care providers in clinical settings encompass multiple goals: preventing the onset or progression of various physical, physiological, and mental health problems through screening, use of preventive medications, and vaccinations and providing information for making good health decisions (8). Interest in preventive services for children and adolescents resulted in formal practice guidelines for infants, children, and adolescents in the 1980s, such as those found in the Guide to Clinical Preventive Services (8). Additional formal practice guidelines for adolescents, known as the Guidelines for Adolescent Preventive Services (GAPS) by the American Medical Association (AMA), were published in the 1990s (9,10), as well as the Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents, which was first introduced in 1994 and supported by the Health Resources and Services Administration (HRSA),

Maternal and Child Health Bureau, and the American Academy of Pediatrics (AAP) (11). Various professional organizations (e.g., AAP and the American Academy of Family Physicians [AAFP]) develop condition-specific guidelines and recommendations as needed using an evidence-based process (12–14). Additionally, the U.S. Preventive Services Task Force (USPSTF) (15), the Advisory Committee on Immunization Practices (ACIP) (16), the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (DACHDNC) (17), and other committees (18) make recommendations for clinical preventive services applicable to infants, children, and adolescents.

Certain clinical preventive services guidelines for infants, children, and adolescents are consistent among advisory groups because they are often collaboratively prepared or jointly recommended, such as the collective approval of child and adolescent immunization schedules by ACIP, AAP, AAFP, and the American College of Obstetricians and Gynecologists (19). However, other clinical preventive services guidelines for infants, children, and adolescents differ between professional societies or advisory groups. For example, differences exist in screening recommendations between those of USPSTF and Bright Futures, particularly for school-aged children and adolescents, for depression, dyslipidemia, hearing problems, hypertension, testicular cancer, and vision problems (20). Additional differences exist in recommendations for screening and counseling for high-risk behaviors (e.g., tobacco, alcohol, and drug use) and for addressing sexual activity and sexually transmitted infections (21). These differences typically occur because professional society guidelines often are developed to inform the needs of current clinical practice and might include expert opinion rather than relying solely on evidence-based review.

Even when there are specific guidelines and recommendations from advisory groups and professional societies, substantial opportunities remain to improve uptake and use of the clinical preventive service. For example, although the level of vaccine coverage among children aged 4–6 years is generally high ($\geq 90\%$ [22]), this level is below the *Healthy People 2020* target of $\geq 95\%$, and coverage for some vaccines remain relatively low. For example, vaccination coverage for tetanus, diphtheria, acellular pertussis vaccine and the meningococcal conjugate vaccine in 2011 among adolescents aged 13–17 years was 78.2% and 70.5%, respectively (23). The challenge is even greater for other health indicators where screening and intervention could substantially improve child and adolescent health. For example, 18.1% of U.S. high school students in 2011 were current cigarette smokers (i.e., smoked cigarettes on at least 1 day during the 30 days before the survey) and, among these, 49.9% had tried to quit during the preceding 12 months (24); however, this percentage is well below the

Healthy People 2020 tobacco use objective of 64% for the proportion of adolescent smokers in grades 9–12 with a past year quit attempt (25). Similarly, 42% of children aged 2–11 years have dental caries in their primary teeth, and 59% of adolescents aged 12–19 years have dental caries in their permanent teeth. However, the percentage of children using dental care is suboptimal (e.g., <50% of children aged 2–5 years visited a dentist during the preceding year) (26).

Provision of clinical preventive services for adolescents presents additional challenges not typically encountered for younger children. Potential adolescent health problems include the use of tobacco, alcohol, and drugs; unintended injuries, violence, and suicide; sexually transmitted infections; and unintended pregnancy. Although many adolescent health problems and approximately 75% of the causes of adolescent mortality (i.e., motor vehicle accidents, homicide, and suicide) are potentially preventable (27), many preventive services recommendations lack sufficient evidence of effectiveness (28). Successes in achieving targeted reductions in these risky behaviors or outcomes in the United States have been mixed (29,30). Success at screening and counseling for high-risk behaviors is hindered by the fact that these are typically sensitive health-compromising behaviors that require discussion in a confidential environment (31–34), and some states include limitations on the types of care and/or counseling that can be provided to children and adolescents (35). Despite the dissemination of guidelines, frequency of service delivery is relatively low for adolescent clinical preventive services with good evidence of effectiveness (28), which occurs in both private practice and community-based settings and in managed care organizations (36–39). Barriers to guideline implementation include physician knowledge and attitudes (40,41) and constraints on the amount of time health-care providers have available for comprehensive preventive health screening and counseling (33,42). Despite these barriers, provision of effective training, tools, and resources can increase preventive screening and counseling of adolescents across multiple risky health behaviors (43,44).

A recent study evaluated the evidence of effectiveness of clinical preventive services in relation to the clinically preventable burden (CPB), defined as quality-adjusted life years (QALYs), that could be gained if the services were delivered at recommended intervals to four million persons in the United States from birth, and cost effectiveness (CE), defined as the incremental net cost per QALY gained in typical practice by offering the clinical preventive service to the same target population of four million persons when compared with not offering the clinical preventive service (45,46). The study included a scoring system for making distinctions among clinical preventive services without overstating the

precision of the CPB and CE estimates. Services were sorted in descending order by the CPB base-case estimates and in ascending order by the base-case incremental cost effectiveness ratios (ICERs). Services were then divided into quintiles so that services with the highest CPB were assigned a CPB score of five and those with the lowest ICERs were assigned a CE score of five. Scores for CPB and CE were added such that the total possible score was between two and 10. The majority of the 25 clinical preventive services evaluated in this manner were not applicable to infants, children, and adolescents. However, among the four applicable services, a high score of 10 was achieved for vaccinating children, a score of six (CPB and CE scores of two and four, respectively) was achieved for screening women aged <25 years for chlamydia and screening children aged <5 years for visual impairments, and a score of four (CPB and CE scores of one and three, respectively) was achieved for injury prevention counseling for parents of children aged <5 years (45). A follow-up study evaluated whether clinical preventive services saved money. For childhood vaccination, 1,233 life years were saved per 10,000 persons per year of intervention with a substantial annual net medical cost savings of \$2.67 million (2006 dollars) for 10,000 persons receiving the intervention. For both chlamydia and childhood vision screening, even though the life years saved per 10,000 persons per year of intervention was zero, and increasing use to 90% was not predicted to produce a net medical savings, these clinical preventive services were determined to be cost effective (CE range, defined as dollar per QALY saved, discounted: >\$0–<\$14,000) for each (1,45). Although there are extremely favorable effects of childhood vaccination and high cost effectiveness for chlamydia and childhood vision screenings, the lack of published data on the effectiveness and value of many clinical preventive services for children and adolescents indicates the need for more research in this area.

Role of Public Health in Clinical Preventive Services

Because of their focus on population health, public health agencies had and will continue to have important roles in increasing use of recommended clinical preventive services (47–52). Two long-standing roles for public health are developing policies and practices to improve individual and community health and ensuring provision of health care when it is not otherwise available (49–51). For example, federally supported panels make policy recommendations for a range of clinical preventive services including newborn screening (17); hearing screening (53); lead screening (54); prevention and control of caries using fluoride (55); vaccinations of children and

adults (56, 57); and counseling, screening, and prevention of human immunodeficiency virus (HIV) and sexually transmitted infections (58,59). In addition, public health agencies improve access to clinical preventive services to the broader population by providing services directly; funding the delivery of services through nonprofit community public health clinics, school-based health centers, community organizations, or private practices; and providing selected services in nontraditional settings (60–62). For example, there are approximately 2,000 school-based health centers in the United States (63), each of which is a partnership between the school and a community-health organization. The HRSA Health Center Program provides funding to approximately 20% of these health centers (63). Other sources of funding include state government, private foundations, sponsored organizations, and school districts. Services typically provided at these health centers include primary medical care, mental/behavioral health care, dental/oral health care, health education and promotion, substance abuse counseling, case management, and nutrition education; however, the specific services provided at each center vary based on community needs and resources (63).

Another important role of public health is identifying community preventive services (e.g., policies, laws, programs and initiatives, education programs, and health system interventions) that are effective in increasing use of clinical preventive services (48,51). To support this function, in 1996, the U.S. Department of Health and Human Services established the Community Preventive Services Task Force (CPSTF) to examine the effectiveness of a range of community preventive services. CPSTF conducts systematic literature reviews to evaluate evidence and uses explicit criteria and procedures to make recommendations (48). Among the community preventive services reviewed and recommended by CPSTF are policy and health system interventions that facilitate the delivery of clinical preventive services through reduction of patients' out-of-pocket costs, reducing barriers to access, and using patient tracking systems to identify eligible patients and provide decision support. For example, CPSTF recommends reducing client out-of-pocket costs for vaccination; increasing vaccination rates through home visits; establishing vaccination programs in schools, organized child care centers, and the special supplemental nutrition program for women, infants and children settings; providing client or family incentive rewards for vaccination; and establishing client reminder and recall systems. In addition, CPSTF recommends ongoing surveillance to monitor, evaluate, and report on performance in the use of clinical preventive services, which is an effective and important means of increasing service delivery by clinicians and health plans (48). CPSTF also reviews and makes recommendations about policy changes, public health

education programs, school-based policies and programs, and changes in the physical and social environment to promote use of clinical preventive services and healthy behaviors (e.g., tobacco avoidance, physical activity programs in schools, behavioral interventions to reduce screen time to improve weight-related outcomes, and use of child safety seats and safety belts) (64).

Public health agencies also collaborate with other stakeholders to implement effective community interventions to increase use of clinical preventive services among infants, children, and adolescents. Population health is affected not only by services provided by the health-care system and public health agencies but also by the activities of private and voluntary organizations, employers, health plans, and other stakeholders (49–52). Each stakeholder can implement interventions to increase use of clinical preventive services. CDC has played a leading role in collaborating with stakeholders at the national level and in supporting state and local public health agencies to develop community coalitions to engage in prevention and control programs, including, but not limited to, increasing implementation of interventions recommended by CPSTF (58,65–67). For example, CDC and its parent department, the U.S. Department of Health and Human Services, convened work groups of fluoride experts to develop recommendations for using fluoride to prevent and control caries (55,68). In addition, CDC convened an expert work group to review and update the recommendations for school-based dental sealant programs (69). CDC staff also served as members of panels sponsored by the American Dental Association Council on Scientific Affairs and collaborated with CPSTF to develop an evidence review for the prevention and control of dental caries in children (70).

Finally, to help other stakeholders plan effective collaborations, public health has a role in monitoring, evaluating, and reporting on progress among communities and stakeholders in increasing use of recommended clinical preventive services (52,71). Examples of such surveillance include CDC-funded Early Hearing Detection and Intervention programs, which help ensure that infants are screened for hearing loss and receive recommended follow-up through active tracking, surveillance, and coordination with clinical service providers and families (72). To promote accountability among stakeholders responsible for population health, public health authorities will need to develop additional performance-measurement systems that track specific, effective actions by stakeholders (e.g., use of parent/patient tracking and reminder systems for clinical preventive services) as well as benchmark measures of key health outcomes (e.g., the proportion of children with genetic disorders or sensory problems identified during the newborn period) and systems to track use of resources and costs (52,71).

Opportunities Offered by Recent Changes to the U.S. Health-Care System

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (73–77). The goal of the law is to have the states expand Medicaid to cover persons with incomes up to 138% of the federal poverty level (FPL) (ACA § 2001). State Medicaid programs are required to cover children aged 0–6 years with family incomes up to 133% of FPL and children aged 6–18 years with family incomes up to 100% of FPL. The Children's Health Insurance Program (CHIP) offers health insurance coverage for some children depending on the income eligibility levels set by each state. ACA extends authorization for CHIP through 2019 and CHIP funding through 2015. The law also provides up to a 23 percentage point increase in the federal medical assistance percentage (FMAP) used to determine federal support to states for their CHIP program from October 2015 through September 2019 (ACA § 2101). Starting in 2014, the law also extends Medicaid coverage to children aged <26 years who were in foster care when they became 18 years old (ACA § 2004). Finally, the law requires that states maintain current income eligibility levels for children in Medicaid and CHIP through September 30, 2019 (ACA § 2001).

The U.S. Supreme Court determined in *National Federation of Independent Business v. Sebelius* that the states are not required to expand their Medicaid programs. But the law incentivizes Medicaid expansion in the states by covering nearly all the costs for the newly Medicaid eligible. Approximately half of states plan to expand their Medicaid programs, resulting in an estimated 12 million new Medicaid enrollees by 2019 (78,79). States that have not yet chosen to expand their Medicaid programs can do so at any time and still benefit from substantial federal funding.

As of September 23, 2010, Section 1001 of the ACA requires that new (or “nongrandfathered”) group or individual private health plans provide coverage for four categories of clinical preventive services, with no cost-sharing for 1) services graded A (strongly recommended) or B (recommended) by USPSTF; 2) vaccinations recommended by ACIP; 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP and those developed by the DACHDNC;

and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (ACA § 1001). Under regulations adopted by the U.S. Department of Health and Human Services, states that expand their Medicaid programs must offer these four types of services to enrollees in expanded Medicaid (80). Also, the law provides a one percentage point increase in FMAP for states that cover with no cost-sharing for all Medicaid beneficiaries all of the recommended preventive services graded A or B by USPSTF and vaccinations recommended by ACIP (ACA § 4106). Several provisions in ACA also promote clinical recommended preventive services in persons who receive benefits from Medicare (81).

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.[†] Federal tax credits are available on a sliding scale to assist eligible persons living at 100%–400% of FPL who purchase health insurance through the Marketplace (ACA § 1401). All qualified plans in the Marketplace are required to offer a package of essential health benefits, which must include items and services within at least the following 10 categories: ambulatory patient services; emergency services; hospitalization; maternity and newborn care; mental health and substance use disorder services, including behavioral health treatment; prescription drugs; rehabilitative and habilitative services and devices; laboratory services; preventive and wellness services and chronic disease management; and pediatric services, including oral and vision care (ACA § 1302). On the basis of a state-selected benchmark plan, each state determines the specific evidence-based clinical services that will be included in their essential health benefit package given these required categories.

ACA also expands consumer protections by guaranteeing the issuance of insurance, ending denials of coverage for preexisting conditions, prohibiting rescission (dropping coverage) and lifetime coverage limits, and ensuring emergency care can be sought at an out-of-network hospital without prior approval of a person's health plan (ACA § 1001). This protection has important implications for children with chronic conditions, including many of those identified through one-time and periodic clinical preventive services (e.g., newborn, sensory, and developmental screening). The law expands access to primary care providers by making substantial investments in the primary care workforce through recruitment and retention

[†]The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

programs, including loan repayment (ACA § 5204), and training for primary care professions (ACA § 5301). The law encourages coordinated care for infants, children, and adolescents through the Medicaid Pediatric Accountable Care Organization Demonstration Project (ACA § 2706). In addition, the law provides for prevention outside of the clinical setting, for example, by creating and providing funding for the Prevention and Public Health Fund, with the goals of enabling communities to prevent the leading causes of death, strengthening state and local disease detection and response, and producing information for action (ACA § 4002).

ACA also includes the National Prevention Strategy, a comprehensive plan created by the National Prevention Council in consultation with the public and an advisory group of nonfederal experts. The National Prevention Strategy aims to improve public health by helping to create healthy and safe communities, expand clinical and community-based preventive services, empower persons to make healthy choices, and eliminate health disparities (ACA § 4001). The National Prevention Strategy has identified seven priority areas with evidence-based recommendations. These priorities include recommendations to improve infant, child, and adolescent health: providing effective sexual health education, especially for adolescents and enhancing early detection of HIV, viral hepatitis, and other sexually transmitted infections and improving linkage to care (priority: reproductive and sexual health); expanding use of tobacco cessation services (priority: tobacco-free living); supporting policies and programs that promote breastfeeding (priority: healthy eating); creating environments that empower young persons not to drink or use other drugs, and identifying alcohol and other drug abuse disorders early and providing brief intervention, referral, and treatment (priority: preventing drug abuse and excessive alcohol use); promoting and strengthening school and early learning policies and programs that increase physical activity (priority: active living); implementing and strengthening policies and programs to enhance transportation safety (priority: injury- and violence-free living); and promoting positive early childhood development, including positive parenting and violence-free homes (priority: mental and emotional well-being) (82).

About This Surveillance Supplement

This surveillance supplement is the second of a series of periodic reports from CDC to monitor and report on progress made in increasing the use of clinical preventive services to improve population health. This supplement focuses on the use of selected services to improve the health of U.S. infants,

children, and adolescents. The audience for the report is the broad range of stakeholders who shape the health of the U.S. infant, child, and adolescent population, including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations. Before selecting a limited set of clinical preventive services to include in this report, CDC considered a wide range of services linked to the prevention or control of a specific condition or disorder. For example, CDC considered the set of clinical preventive services for infants, children, and adolescents that were identified by ACA and that have been evaluated and recommended by various Federal advisory or guideline development committees (73). Also reviewed were clinical preventive services in the Bright Futures/AAP Periodicity Schedule (11) and clinical preventive services relevant to infants, children, and adolescents in areas of public health identified by CDC as priorities, including newborn and developmental screening, vaccinations, motor-vehicle injuries, obesity/nutrition/physical activity, teen pregnancy, and tobacco use (83).

To select indicators important to the public, stakeholders, and policy makers, CDC identified a set of clinical preventive services that 1) are important in helping to decrease childhood illness, injury, or disability across the developmental spectrum from infancy to late adolescence; 2) are underused but have the potential for substantial increases in use over the next few years with focused effort; 3) have important effects on infant, child, and adolescent health, as measured by potential healthy life years gained (1,45); 4) are priorities of CDC public health programs and the coalitions of stakeholders; and 5) have routinely collected nationally representative surveillance data available for measurement. Also considered was whether the same or similar indicators were used by other national efforts to monitor and promote progress in use of clinical preventive services, including *Healthy People 2020*, the National Quality Forum, and the National Committee for Quality Assurance (84–86).

Using these criteria, CDC initiated an iterative process to develop the final list of indicators. A work group that included leaders from multiple CDC programs was formed to develop a proposal; the proposal was then reviewed in more detail by experts from a broader set of CDC programs. A revised proposal was developed and approved by CDC.

Clinical Preventive Services Indicators

The indicators included in this supplement address the clinical preventive services that not only are important in

various life stages of development in infants, children, and adolescents, but also have surveillance data available for measurement: prenatal period (breastfeeding counseling); infancy (hearing screening and follow-up and developmental screening); early and middle childhood (lead screening, vision screening, hypertension screening, and provision of dental care and preventive dental services); and adolescence (human papillomavirus vaccination, tobacco use screening and cessation assistance, chlamydia screening, and provision of reproductive health services) (Table). Several of the indicators are for services recommended by USPSTF, ACIP, DACHDNC, and Bright Futures, but others also are included. The indicators measure use of clinical preventive services that have been demonstrated to be underused and that, if increased over the next few years, could substantially improve the health of U.S. infants, children, and adolescents. Improvement in the use of the services described in this surveillance supplement is also a focus of public health and community programs as well as national health-care quality improvement efforts.

Services for pregnant women were initially included for consideration in this supplement, but because of the large number of clinical preventive services recommended for infants, children, and adolescents combined, and recognizing that the set of stakeholders and surveillance systems for child and adolescent services differ somewhat from those for pregnant women's services, CDC decided to limit the scope of this supplement to infant, child, and adolescent services and only included one service for pregnant women that is most relevant for the infant and child time frame (i.e., breastfeeding counseling).

For multiple reasons, certain important services for infants, children, and adolescents were not included. For example:

- DACHDNC has a Recommended Universal [newborn] Screening Panel of 31 conditions, including 29 conditions identified from laboratory analysis of the newborn blood spot, hearing loss identified from select audiologic screening technologies, and critical congenital heart disorders identified from pulse oximetry screening (87). Only newborn hearing screening is included in this report because it is the one component of newborn screening that has a national surveillance and tracking system for monitoring implementation.
- USPSTF does not have recommendations for childhood injury prevention except for the determinations that evidence is insufficient to assess 1) the incremental benefit, beyond the efficacy of legislation and community-based interventions, of counseling in the primary care setting, in improving rates of proper use of motor vehicle occupant restraints children and adolescents and 2) the balance of

benefits and harms of primary care interventions to prevent child maltreatment among children without signs or symptoms of maltreatment (15).

- Screening for obesity and alcohol are recommended by USPSTF (15), but surveillance data were not available for adequate indicators.
- Screening for depression in adolescents was not included because surveillance systems do not have information on the ability of clinician practices to provide effective supportive care for depression. USPSTF recommends depression screening in children and adolescents only when staff-assisted depression care supports are available to assure accurate diagnosis, effective treatment, and follow-up (15).
- Screening for dyslipidemia in children aged ≥ 9 years and for those at high risk was not included because no surveillance data were available.

Additionally, universal influenza vaccination and vaccination for other diseases in infants, children, and adolescents have been recommended by ACIP and have a complimentary surveillance system, but are extensively covered in other periodic CDC publications (23,88–91). Finally, HIV screening in adolescents was addressed in the adult supplement (92).

Use of This Report

Several uses for the type of information provided in this supplement were outlined in the 2011 Institute of Medicine report on the role of measurement in action and accountability in public health (52). The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (e.g., public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. Stakeholders can use this information to increase use of these services and promote responsibility and accountability among partners for implementing effective strategies to increase use. In addition, publication of this information on a diverse set of selected services for infants, children, and adolescents will increase awareness and offer the opportunity for stakeholders to reduce the burden of illness and disability by coordinating efforts when appropriate to increase use of these preventive services for all U.S. infants, children, and adolescents.

TABLE. Selected clinical preventive services and the clinical practice recommendation or guideline for the preventive service, by topic, indicator of service use, and recommending organization — United States, 2014

Topic/Indicator	Recommending organization(s)
Breastfeeding counseling	
Percentage of women with recent live births who reported receiving any advice about breastfeeding during prenatal care visits	USPSTF*
Hearing screening and follow-up	
Percentage of infants who have received diagnostic testing needed to confirm hearing loss	USPSTF†/AAP§
Developmental screening	
Percentage of children aged 10–47 months whose parents were asked by health-care providers to complete a former screen for developmental delays during the preceding 12 months	AAP§
Lead screening	
Percentage of children aged 1–2 years who were screened and reported to CDC for lead poisoning	AAP§
Vision screening	
Percentage of children aged 5 years who were reported by their parents to have ever had their vision checked by a doctor or other health provider	USPSTF¶/AAP§
Hypertension screening	
Percentage of provider reported office-based and hospital outpatient department preventive care visits with documentation of blood pressure measurement among children and adolescents aged 3–17 years	AAP§
Percentage of children and adolescents aged 3–17 years who were reported by their parents or caregivers to have had their blood pressure measured by a doctor or other health provider at a nonemergency care physician or clinic visit during the preceding year	AAP§
Dental care and dental preventive services	
Percentage of persons aged ≤21 years who have visited the dentist during the preceding year	AAP§
Percentage of persons aged ≤21 years who have received dental preventive services (topical fluoride, sealant or both) during the preceding year	AAP§
Percentage of persons aged 5–19 years who have a dental sealant	AAP§
Human papillomavirus (HPV) vaccination	
Percentage of adolescent females aged 13–17 years who have received ≥1 dose of HPV vaccine	ACIP**/AAP§
Percentage of adolescent females aged 13–17 years who have received ≥3 doses of HPV vaccine	ACIP**/AAP§
Percentage of adolescent males aged 13–17 years who have received ≥1 dose of HPV vaccine††	ACIP§§/AAP§
Percentage of adolescent males aged 13–17 years who have received ≥3 doses of HPV vaccine††	ACIP§§/AAP§
Tobacco use screening and cessation assistance	
Provider reported office-based outpatient visits with documentation of tobacco use status among persons aged 11–21 years	USPHS¶¶/AAP§
Provider reported office-based outpatient visits with documentation of tobacco cessation assistance, including counseling and/or a prescription or order for a cessation medication among current tobacco users in persons aged 11–21	USPHS¶¶/AAP§
Chlamydia screening	
Percentage of sexually active females aged 15–21 years who reported being tested for chlamydia during the preceding 12 months	USPSTF***/GAPS†††/AAP§
Percentage of provider reported office-based ambulatory care setting visits with screening for chlamydia among females aged 15–21 years	USPSTF***/GAPS†††/AAP§
Reproductive health services	
Percentage of sexually experienced females and males aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	GAPS†††/AAP§
Percentage of all females and males aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	GAPS†††/AAP§

Abbreviations: USPSTF = U.S. Preventive Services Task Force; AAP = American Academy of Pediatrics; USPHS = U.S. Public Health Service; ACIP = Advisory Committee on Immunization Practices; GAPS = Guidelines for Adolescent Preventive Services.

* **Source:** U.S. Preventive Services Task Force. Primary care interventions to promote breastfeeding. Available at: <http://www.uspreventiveservicestaskforce.org/uspstf/uspbrfd.htm>. Breastfeeding counseling during prenatal care visits is also recommended by the American Congress of Obstetricians and Gynecologists and the American Academy of Pediatrics.

† **Source:** U.S. Preventive Services Task Force. Universal screening for hearing loss in newborns. Available at: <http://www.uspreventiveservicestaskforce.org/uspstf/uspnbhr.htm>.

§ **Source:** Hagan JF, Shaw JS, Duncan PM, eds. Bright futures: guidelines for health supervision of infants, children, and adolescents. Third ed. Elk Grove Village, IL: American Academy of Pediatrics; 2008.

¶ **Source:** U.S. Preventive Services Task Force. Screening for visual impairment in children ages 1 to 5 years. Available at: <http://www.uspreventiveservicestaskforce.org/uspstf/uspvsch.htm>.

** **Source:** Advisory Committee on Immunization Practices. Quadrivalent human papillomavirus vaccine. Recommendations of the Advisory Committee on Immunization Practices (ACIP). Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5602a1.htm>.

†† Because most 2011 NIS–Teen data were collected before ACIP recommended routine male HPV4 vaccination in October 2011, findings from this indicator represent baseline data for monitoring that recommendation's implementation.

§§ **Source:** Advisory Committee on Immunization Practices. Recommendations on the Use of quadrivalent human papillomavirus vaccine in males — Advisory Committee on Immunization Practices (ACIP), 2011. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6050a3.htm>.

¶¶ **Source:** Fiore MC, Jaen CR, Baker TB, et al. Treating tobacco use and dependence: 2008 update. Clinical practice guideline. Rockville, MD: US Department of Health and Human Services, Public Health Service; 2008. Available at http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/tobacco/clinicians/update/treating_tobacco_use08.pdf.

*** **Source:** U.S. Preventive Services Task Force. Screening for chlamydial infection. Available at: <http://www.uspreventiveservicestaskforce.org/uspstf/uspchlmm.htm>.

††† **Source:** Elster AB, Kuznets NJ, eds. AMA Guidelines for Adolescent Preventive Services (GAPS): Recommendations and Rationale. Baltimore, MD: Williams & Wilkins; 1994.

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Prenatal Breastfeeding Counseling — Pregnancy Risk Assessment Monitoring System, United States, 2010

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Introduction

Breastfeeding is a highly effective preventive measure a mother can take after birth to protect the health of her infant, as well as her own. Immunologic and antiinflammatory properties of breast milk protect against numerous illnesses and diseases in children (1). Benefits of breastfeeding for infants include a lower risk for ear infections (2), atopic dermatitis (3), lower respiratory tract infections (4), sudden infant death syndrome (SIDS) (2,5), necrotizing enterocolitis (NEC) in preterm infants (2), type 2 diabetes (6), asthma (7), and childhood obesity (8–10). For mothers, benefits of breastfeeding include a lower risk for breast cancer (11–13) and ovarian cancer (2). Increasing rates of breastfeeding and therefore its health benefits might lower health-care costs. A recent study found that if higher rates of mothers complied with medical recommendations for breastfeeding, an estimated \$2.2 billion in additional direct medical costs would be saved annually in the United States (14).

The American Academy of Pediatrics (AAP) stated in its 2012 policy statement on breastfeeding that exclusive breastfeeding for the first 6 months of life is sufficient to support optimal growth and development and recommended that breastfeeding be continued for at least the first year of life and beyond (15). In 2010, the Joint Commission included exclusive breastfeeding during the newborn's entire hospitalization as part of a set of five nationally implemented measures that address perinatal care, endorsed by the National Quality Forum (NQF #0480) (16). Within the last decade, breastfeeding rates have been increasing; however, despite overall improvements, rates for breastfeeding duration remain relatively low, with only 49.4% of U.S. infants breastfed to any extent at age 6 months and only 18.8% of children exclusively breastfed through the recommended age of 6 months (17). *Healthy People 2020* national breastfeeding objectives are to increase the proportion

of infants who are ever breastfed to 81.9%, who are breastfed to any extent at 6 months to 60.6% and at 1 year to 34.1%, and who are exclusively breastfed through 3 months to 46.2% and through 6 months to 25.5% (objectives MICH-21.1, 21.2, 21.3, 21.4 and 21.5) (18).

AAP cites insufficient prenatal education about breastfeeding as an obstacle to initiation and continuation of breastfeeding (19). The U.S. Preventive Services Task Force (USPSTF) found adequate evidence indicating that interventions, such as formal breastfeeding education for mothers and families, increase the rates of initiation, duration, and exclusivity of breastfeeding. Therefore, the USPSTF guidelines recommend interventions during pregnancy and after birth to promote and support breastfeeding. This is a USPSTF Grade B recommendation, which means that there is moderate certainty that the interventions have a moderate net benefit (20). In addition, AAP, the American Academy of Family Physicians, and the American College of Obstetricians and Gynecologists all recommend that pregnant women receive breastfeeding education and counseling throughout the perinatal period (19,21,22). Public health officials and clinicians play an important role in promoting and supporting breastfeeding and have the opportunity to not only increase mothers' breastfeeding knowledge and skills but also to influence attitudes toward breastfeeding by providing and encouraging the use of breastfeeding education and support during pregnancy and postpartum.

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve

the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (23). This report analyzes 2010 data from the Pregnancy Risk Assessment Monitoring System (PRAMS) to estimate the proportion of women with recent live births who received breastfeeding counseling during prenatal care visits. Public health professionals and clinicians can use the data to identify specific subgroups of women and geographic areas in need of targeted interventions to increase prenatal breastfeeding counseling rates in the United States.

Methods

To estimate the proportion of women who received counseling on breastfeeding during the prenatal period, CDC analyzed 2010 data from PRAMS, a multistate, population-based surveillance system that collects data on a wide range of maternal behaviors and experiences before, during, and after pregnancy (24).

In 2010, PRAMS surveys were administered by 37 states and New York City (all of which are referred to as states in this report). New York City and New York State have separate vital registration systems; therefore, they are included as separate geographic entities. Each month, participating states select a stratified random sample from birth certificate records of 100–300 women with recent live births, for an annual sample of approximately 1,300–3,400 women in each participating state. A questionnaire is mailed to mothers 2–6 months after delivery. The participating sites use a standard core questionnaire to which they can add questions. Women receive up to three questionnaire mailings and receive follow-up by telephone if they do not respond. The PRAMS 2010 question on prenatal breastfeeding counseling was: “During any of your prenatal care visits, did a doctor, nurse, or health-care worker talk with you about any of the things listed below?” Among a list of 12 items, one focuses on breastfeeding: “Breastfeeding my baby,” with response options of no or yes. The estimation of breastfeeding counseling coverage is only among mothers who reported receiving prenatal care; however, because <1% of women reported not having had prenatal care, nearly all women in the sample are included. Although the 2010 PRAMS data were collected in 38 states, only 26 states are included in this analysis; nine states did not reach the 65% response rate threshold set by CDC PRAMS for the release of data, and three states did not have weighted data available. States included in the analysis were Alaska, Arkansas, Colorado, Delaware, Georgia, Hawaii, Massachusetts, Maryland, Maine, Minnesota, Missouri, Nebraska, New Jersey, New York, New York City,

Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Washington, West Virginia, and Wyoming.

PRAMS data were weighted to take into account complex survey design, nonresponse, and noncoverage for each state. Calculated prevalence estimates and 95% confidence intervals were stratified by state and maternal sociodemographic variables, including age, race/ethnicity, parity, body mass index, poverty-income ratio (PIR), education, language of survey, marital status, prenatal care initiation, insurance type at prenatal visit, and receipt of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) services during pregnancy. Chi-square tests were used to test for statistically significant differences in the prevalence estimates; *p* values of <0.05 were considered statistically significant. All analyses were conducted using statistical software.

Results

Overall, 82.7% of women reported receiving advice about breastfeeding during their prenatal care visits (Table 1). The prevalence of receipt of prenatal breastfeeding advice was higher among women aged <20 years (92.5%) than among those aged ≥25 years (75.9%–83.5%). Non-Hispanic white women (79.4%), women with a PIR >200% (76.9%), and women with more than a high school education (77.9%) all reported a lower prevalence of receipt of prenatal breastfeeding advice than non-Hispanic black (91.3%) and Hispanic (87.8%) women, women with a PIR <200% (85.1%–89.7%), and women with a high school education or less (88.2%–89.8%), respectively. A higher prevalence of receipt of prenatal breastfeeding advice at prenatal visits was also reported by women who had Medicaid (89.8%) compared with women who had private insurance at prenatal visits (75.7%) and by women who reported receiving WIC services during pregnancy (90.8%) compared with those who did not (75.2%).

The overall prevalence of prenatal breastfeeding advice was consistently high across states, with approximately 80% of women reporting receipt of prenatal breastfeeding advice in all states except two (New Jersey and Utah) (Table 2). In three states (Georgia, Massachusetts, and Vermont), approximately 90% of women reported receiving prenatal breastfeeding advice.

Discussion

Although the overall prevalence of women who received breastfeeding advice in 2010 was high, 17% of women who received prenatal care reported that they did not receive any advice during their prenatal care visits. Some variations by state and maternal sociodemographic characteristics were observed.

TABLE 1. Prevalence of receipt of prenatal breastfeeding advice among women, by selected maternal demographic characteristics — Pregnancy Risk Assessment Monitoring System, United States, 2010

Characteristic	No.	%*	(95% CI)
Age (yrs)[†]			
<20	3,022	92.5	(90.2–94.2)
20–24	8,237	89.9	(88.6–91.1)
25–29	10,324	83.5	(82.1–84.7)
30–34	8,753	75.9	(74.3–77.5)
≥35	5,717	76.1	(74.1–78.1)
Race/Ethnicity^{‡,§}			
White, non-Hispanic	19,501	79.4	(78.4–80.3)
Black, non-Hispanic	5,025	91.3	(89.9–92.5)
Hispanic	5,917	87.8	(86.0–89.4)
Other	5,450	77.3	(74.7–79.6)
Parity[†]			
1	15,224	85.7	(84.7–86.7)
2	10,975	80.4	(79.1–81.7)
≥3	9,675	80.8	(79.3–82.2)
Body mass index (kg/m²)[†]			
Underweight (<18.5)	1,691	80.7	(76.9–84.0)
Normal (18.5–24.9)	17,110	81.1	(80.1–82.2)
Overweight (25.0–29.9)	8,090	84.1	(82.7–85.4)
Obese (≥30)	7,238	84.1	(82.4–85.6)
Poverty-income ratio^{†,¶}			
≤100%	11,332	89.7	(88.5–90.8)
>100%–200%	5,868	85.1	(83.2–86.8)
>200%	12,621	76.9	(75.7–78.2)
Education[†]			
Less than high school	5,777	89.8	(88.1–91.3)
High school	9,410	88.2	(86.9–89.4)
More than high school	20,451	77.9	(76.8–78.8)
Language of survey[†]			
English	33,197	81.9	(81.2–82.6)
Spanish	2,800	89.3	(86.8–91.4)
Marital status[†]			
Married	22,074	77.7	(76.7–78.7)
Not married	13,961	90.4	(89.4–91.3)
Number of prenatal care visits^{**}			
≤8	7,887	83.6	(81.9–85.2)
9–11	10,923	82.4	(81.1–83.6)
≥12	15,550	82.6	(81.6–83.6)
Insurance type at prenatal visit[†]			
Private	15,828	75.7	(74.5–76.8)
Medicaid	14,228	89.8	(88.7–90.7)
Both	1,640	88.4	(84.8–91.2)
Other	3,015	85.3	(82.7–87.6)
WIC services during pregnancy[†]			
Yes	17,536	90.8	(89.9–91.6)
No	18,263	75.2	(74.1–76.3)
Total	36,054	82.7	(82.0–83.4)

Abbreviations: CI = confidence interval; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

* Percentages are weighted.

[†] Chi-square test, $p < 0.001$.

[‡] Hispanics might be of any race or combination of races.

[§] Poverty-income ratio is an index for the ratio of family income to poverty as defined by the U.S. Census Bureau. (Available at [http://www.census.gov/hhes/www/poverty/methods/definitions.html#ratio of income to poverty](http://www.census.gov/hhes/www/poverty/methods/definitions.html#ratio%20of%20income%20to%20poverty).)

^{**} Chi-square test, $p = 0.5$ (not significant).

TABLE 2. Prevalence of receipt of prenatal breastfeeding advice among women, by state — Pregnancy Risk Assessment Monitoring System, United States, 2010

State	No.	%*	(95% CI)
Alaska	1,133	88.8	(86.2–90.9)
Arkansas	1,487	82.4	(79.6–84.8)
Colorado	1,908	84.4	(82.0–86.4)
Delaware	1,074	85.5	(83.3–87.5)
Georgia	1,131	90.2	(87.0–92.7)
Hawaii	1,533	83.1	(80.5–85.4)
Maine	1,470	85.5	(82.8–87.8)
Maryland	1,457	81.2	(78.1–84.0)
Massachusetts	1,053	90.5	(88.3–92.4)
Minnesota	1,322	80.8	(78.4–83.0)
Missouri	1,512	84.0	(81.7–86.0)
Nebraska	1,784	84.5	(82.3–86.4)
New Jersey	1,403	75.0	(72.5–77.3)
New York	989	81.8	(78.6–84.6)
New York City	1,379	81.8	(79.2–84.1)
Ohio	1,265	83.7	(80.8–86.2)
Oklahoma	1,936	83.1	(80.1–85.8)
Oregon	1,728	88.5	(86.2–90.5)
Pennsylvania	1,003	81.1	(78.3–83.7)
Rhode Island	1,262	84.9	(82.5–87.0)
Texas	1,723	81.8	(79.4–84.0)
Utah	1,541	69.3	(66.6–71.8)
Vermont	1,055	90.9	(89.0–92.5)
Washington	1,544	86.5	(84.1–88.6)
West Virginia	1,410	84.5	(82.0–86.7)
Wyoming	952	82.3	(79.3–84.9)
Total	36,054	82.7	(82.0–83.4)

Abbreviation: CI = confidence interval.

* Percentages are weighted.

Geographic variations noted in the prevalence of prenatal breastfeeding advice ranged from 69.3% to 90.9%, a 21.6 percentage point difference. In general, women known to have lower breastfeeding rates (e.g., women who are non-Hispanic black, of low socioeconomic status, or live in the southeastern United States) (17) were more likely to report receiving prenatal breastfeeding advice than women who tend to have higher rates of breastfeeding (e.g., women who are non-Hispanic white, of high socioeconomic status, or live in areas other than the southeastern United States). Although the exact reasons for this observation are unknown, black women and women of lower socioeconomic status might be more likely to be identified as in need of prenatal breastfeeding advice because of the documented disparities in breastfeeding (17). No published research was found on the costs or cost-effectiveness of prenatal breastfeeding counseling.

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and

places a greater emphasis on prevention (25). Comprehensive breastfeeding support and counseling from trained providers during pregnancy, in the postpartum period, or both, as well as access to breastfeeding supplies for pregnant and nursing women, is recommended in comprehensive guidelines supported by the Health Resources and Services Administration (HRSA) specifically for women (26). The use of interventions during pregnancy and after birth to promote and support breastfeeding, which can include breastfeeding counseling, is recommended by USPSTF as a Grade B recommendation (20). Nongrandfathered private health plans (ACA § 1001) and qualified health plans on the new Health Insurance Marketplace (or Health Insurance Exchange) that went into effect starting in 2014 (ACA § 1001) are required to cover these services at no additional cost to the beneficiary.* Although ACA does not require traditional Medicaid/Children's Health Insurance Programs to cover the HRSA-supported and USPSTF-recommended preventive services, states that choose to expand Medicaid to legal residents with incomes up to 138% of the federal poverty level must provide all newly eligible adults with a benchmark benefit package that must cover those recommended services (ACA § 2001). In addition, effective January 1, 2013, states became eligible for an increased federal medical assistance percentage if they covered such preventive services, including breastfeeding counseling, with no co-pay (ACA § 4106). States have the flexibility to cover breastfeeding services in numerous different ways under Medicaid, including inpatient and outpatient hospital services. ACA provides additional support for breastfeeding by requiring employers to provide employees who are breastfeeding with time and a private place for breastfeeding activities (ACA § 4207).

Although the prevalence of breastfeeding intention (80%) and initiation (77%) are high, breastfeeding duration rates in the United States do not meet the *Healthy People 2020* objectives (ever breastfed, 81.9%; breastfed at 6 months, 60.6%; breastfed at 1 year, 34.1%; exclusively breastfed through 3 months, 46.2%; and exclusively breastfed through 6 months, 25.5%)(18,27,28). The data in this report show that a high prevalence of women received prenatal breastfeeding advice, indicating that although prenatal breastfeeding counseling is important, other factors also play important roles in increasing breastfeeding duration. As outlined in the *Surgeon General's Call to Action to Support Breastfeeding*, to help women overcome the numerous barriers to breastfeeding, the support of family members, communities, clinicians,

health-care systems, and employers is crucial (29). A 2012 review found evidence that formal breastfeeding education, as well as peer counseling and lactation consultation, during pregnancy appear to increase breastfeeding duration (30). Furthermore, evidence suggests that interventions with combined prenatal and postnatal components might be the most effective way to increase breastfeeding duration (31,32). Adequate education and training of health-care professionals who work with mothers and infants also are essential because health-care providers have a substantial influence on women's decision and ability to breastfeed (33,34).

The high prevalence of prenatal breastfeeding counseling found in this report combined with the relatively low breastfeeding duration rates in the United States suggest that expanding the focus of programs beyond a single intervention to a more multicomponent approach might be needed to improve breastfeeding outcomes. Several national programs use various approaches to promote and support breastfeeding. The U.S. Department of Agriculture's WIC program has federal regulations that specify the actions state agencies must take to encourage women to breastfeed and to provide appropriate nutritional support for breastfeeding women (35,36). AAP's Safe and Healthy Beginnings program, a framework for continuity of care from the prenatal period through childbirth to the postpartum period and beyond, provides a resource toolkit to hospitals and physicians' offices that covers key topics, including support for breastfeeding mothers (37). Best Fed Beginnings, led by the National Initiative for Children's Healthcare Quality in close partnership with Baby-Friendly USA and with support from CDC, is a nationwide effort to help hospitals improve maternity care and increase the number of hospitals that receive the baby-friendly designation in the United States (38). The Maternity Practices in Infant Nutrition and Care Survey monitors changes in maternity care practices and serves as a quality improvement tool for participating facilities (39).

Limitations

The findings in this report are subject to at least three limitations. First, because PRAMS only provides population-based data for each participating state, results are not generalizable to other states or to the entire United States. Second, because PRAMS data are self-reported, breastfeeding behavior and actual receipt of prenatal breastfeeding counseling cannot be confirmed. Third, prenatal breastfeeding counseling as assessed in PRAMS does not include the quality of the prenatal breastfeeding advice offered to women, such as content or frequency of counseling.

*The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

Conclusion

Overall, approximately 17% of mothers reported that their physician, nurse, or other health-care worker did not talk about breastfeeding during their prenatal care visits. Multicomponent interventions and supports, including prenatal breastfeeding counseling, are needed to help mothers start and continue breastfeeding. By expanding access both to comprehensive support and counseling from trained providers and to breastfeeding supplies, ACA might have an impact on breastfeeding rates in the United States. PRAMS data provide important insight into the prevalence of prenatal counseling about breastfeeding among women with recent live-born infants. This information might be useful in identifying groups that might benefit from additional programs aimed at increasing prenatal breastfeeding counseling rates.

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Early Hearing Detection and Intervention Among Infants — Hearing Screening and Follow-up Survey, United States, 2005–2006 and 2009–2010

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Introduction

Two to three infants per 1,000 live births are born deaf or hard of hearing (1). When left undetected, a hearing loss can delay a child's speech and language development. Approximately 40% of young adults with hearing loss identified during childhood reported experiencing at least one limitation in daily functioning (2). A total of 41 states, Guam, and the District of Columbia have passed statutes or regulatory guidance related to the identification of deaf and hard of hearing infants. All U.S. jurisdictions also have now established Early Hearing Detection and Intervention (EHDI) programs. These programs represent an evidence-based public health approach that connects public health and clinical preventive services to address the needs of infants who are deaf and hard of hearing (3,4). With support from public health agencies at both the jurisdictional and federal levels, EHDI programs help ensure that infants are screened for hearing loss and receive recommended follow-up through active tracking, surveillance, and coordination with clinical service providers and families.

National benchmarks for the EHDI process include screening no later than age 1 month, diagnostic audiologic testing no later than age 3 months (for infants failing the screening), and enrollment in early intervention no later than age 6 months (for those identified with a hearing loss). Progress towards these 1-3-6 benchmarks is measured by *Healthy People 2020* Objective ENT-VSL-1 and three child health quality measures that were endorsed by the National Quality Forum (NQF) in August 2011 (NQF #1354: hearing screening before discharge from the hospital, NQF #1360: audiological evaluation no later than age 3 months [for those failing the screening], and NQF #1361: intervention no later than age 6 months [for those identified with a hearing loss]) (5,6). The lifetime educational cost of hearing loss has been estimated at \$115,600 per child (year 2007 value for >40 dB permanent loss without other disabilities) and is determined on the basis

of average annual expenditures of \$15,992 for elementary and secondary school students who were receiving special education services for hearing loss or deafness during the 1999–2000 school year (7). During the 1999–2000 school year, the total cost in the United States for special education programs for children who were deaf or hard of hearing was \$652 million, or \$11,006 per child (8).

Newborn hearing screening has been recommended by three national organizations. The U.S. Preventive Services Task Force (USPSTF) recommends screening for hearing loss in all newborn infants. This is a USPSTF Grade B recommendation, which means USPSTF recommends the service. There is moderate certainty that the net benefit of screening all newborn infants for hearing loss is moderate (3). Hearing screening also is one of the core conditions included in the Recommended Uniform Screening Panel that was developed by the U.S. Department of Health and Human Services Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC) (3,9). Newborn hearing screening also has been endorsed by the Joint Committee on Infant Hearing (JCIH), whose members include multiple national professional and advocacy organizations (10). Hearing level is measured in decibels (dB) and classified on the basis of laterality (unilateral or bilateral), type (e.g., conductive, sensorineural, mixed, or central), and severity (e.g., mild, moderate, severe, or profound) (11). If a newborn fails the hearing screening typically administered before discharge from the birthing facility, diagnostic testing is needed to confirm if a hearing loss is present. This testing is to be performed by a qualified health-care provider (e.g., pediatric audiologist). Because of the potential effect of hearing loss on a child's ability to develop speech, language, and social skills, intervention services should start as soon as possible and no later than age 6 months (12).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health

(including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (13). This report analyzes 2009–2010 data from the CDC EHDI Hearing Screening and Follow-up Survey (HSFS) and compares it to data from 2005–2006 to assess progress in key areas. These comparisons include the provision of recommended hearing screening, diagnostic, and early intervention services both irrespective of age and in accordance with the 1-3-6 benchmarks. Public health authorities and health-care providers can use these data to assess progress towards national benchmarks and identify areas that require additional attention to ensure infants with hearing loss can reach their full potential.

Methods

To determine the percentage of infants screened for hearing loss, in receipt of a diagnostic audiologic evaluation, and enrolled in early intervention services, CDC analyzed 2009–2010 data from EHDI HSFS. Additional calculations were made to determine the percentage of infants screened before age 1 month, those who received a diagnostic evaluation before age 3 months, and enrolled in early intervention before age 6 months. Descriptive statistics for each year of data were generated using Microsoft Excel (Table 1). The percentage of infants screened for hearing loss was calculated by dividing

the total number documented as screened for hearing loss by the total number of occurrent births in the same reporting year multiplied by 100. The percentage of infants screened before age 1 month was calculated by dividing the number screened before age 1 month by the total screened for hearing loss multiplied by 100. The percentage of infants diagnosed (i.e., hearing loss or no hearing loss) was calculated by dividing the total number identified with hearing loss plus the number reported with no diagnosed hearing loss divided by the total number failing the hearing screening multiplied by 100. The percentage of infants diagnosed before age 3 months was calculated by dividing the number identified with hearing loss before age 3 months plus the number reported with no diagnosed hearing loss before age 3 months divided by the total number diagnosed (i.e., hearing loss or no hearing loss) multiplied by 100. The percentage of infants lost to follow-up (LFU) / lost to documentation (LTD) was calculated by dividing the number unable to contact plus the number unresponsive plus the number unknown divided by the total number failing the hearing screening multiplied by 100. The percentage of infants enrolled in early intervention (of those with a diagnosed, permanent hearing loss) was calculated by dividing the total number enrolled in intervention divided by the total number diagnosed with a hearing loss multiplied by 100. The percentage of infants enrolled in early intervention before age 6 months was calculated by dividing the number of infants with hearing loss enrolled in intervention before age 6 months divided by the total number with hearing loss enrolled in intervention multiplied by 100.

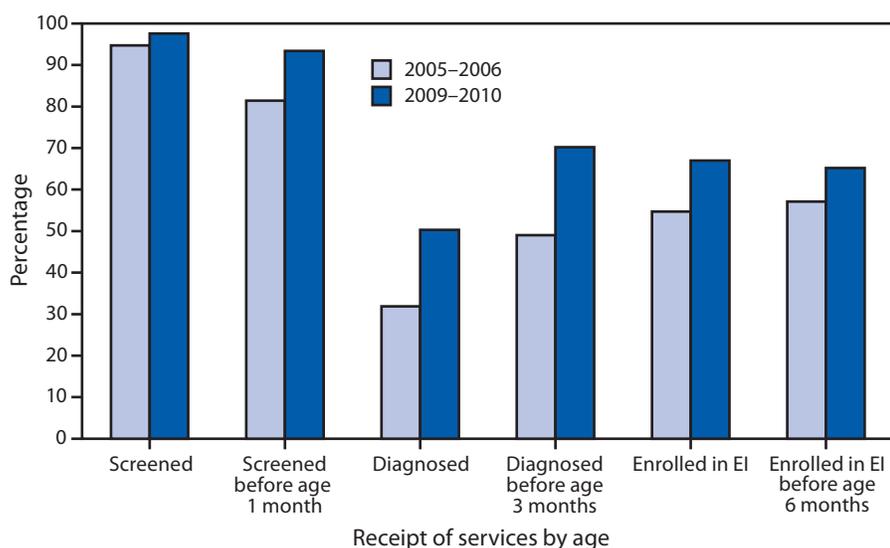
To assess progress and highlight areas for continued improvement, CDC compared the 2009–2010 screening, diagnostic, and intervention data to the same data set for the combined period 2005–2006, which is the earliest information available through this CDC survey (Figure). Because of

TABLE 1. Comparison of infants screened, diagnosed, and enrolled in early intervention, by age — Hearing Screening and Follow-up Survey, United States, 2005–2006 and 2009–2010*

Year	Screened			Diagnosed			Infants with Hearing Loss										
	Births	Total screened		Before age 1 month		Failed screening	Total diagnosed		Before age 3 months		Lost to follow-up/ Lost to documentation	Total identified	Enrolled in early intervention		Enrolled in early intervention before age 6 months		
	No.	No.	(%)	No.	(%)		No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	
2005	3,431,884	3,231,594	(94.2)	2,471,554	(78.4)	60,025	17,691	(29.5)	9,106	(51.5)	38,411	(64.0)	2,634	1,522	(57.8)	868	(57.0)
2006	3,288,626	3,129,585	(95.2)	2,706,029	(86.5)	67,490	23,024	(34.1)	10,831	(47.0)	32,189	(47.7)	3,076	1,703	(55.4)	973	(57.1)
Total:	6,720,510	6,361,179	(94.7)	5,177,583	(81.4)	127,515	40,715	(31.9)	19,937	(49.0)	70,600	(55.4)	5,710	3,225	(56.5)	1,841	(57.1)
2005–2006																	
2009	4,018,885	3,915,360	(97.4)	3,675,149	(93.9)	56,794	27,197	(47.9)	18,603	(68.4)	25,635	(45.1)	5,103	3,445	(67.5)	2,282	(66.2)
2010	3,965,744	3,881,088	(97.9)	3,605,048	(92.9)	59,719	31,370	(52.5)	22,516	(71.8)	23,474	(39.3)	5,035	3,350	(66.5)	2,151	(64.2)
Total:	7,984,629	7,796,448	(97.6)	7,280,197	(93.4)	116,513	58,567	(50.3)	41,119	(70.2)	49,109	(42.1)	10,138	6,795	(67.0)	4,433	(65.2)
2009–2010																	

* Improvements in the screening, diagnosis, and early intervention rates in 2009–2010, compared with 2005–2006, were statistically significant ($p < 0.05$ for all).

FIGURE: Percentage of infants screened, diagnosed, and enrolled in early intervention — Hearing Screening and Follow-up Survey, United States, 2005–2006 and 2009–2010



Abbreviation: EI = early intervention.

the incompleteness of data during 2005–2006, a similar comparison between the demographic data for 2009–2010 and 2005–2006 was not possible. For all comparisons, statistical significance was determined using a two-sided z test; differences were considered statistically significant at $p < 0.05$.

The HSFS is an annual, online survey administered by CDC and sent to the EHDI Program Coordinator in each U.S. state, territory, freely associated state, and the District of Columbia. The survey requests aggregate, nonestimated information related to the receipt of hearing screening, diagnostic testing, and enrollment in early intervention for every occurrent birth within the jurisdiction. Infants were classified as LFU if they did not receive recommended follow-up services or LTD if they received services without the results being reported to the jurisdictional EHDI program. Cases where the infant died or the parents refused services were not classified as LFU/LTD. Although strategies used to target LFU and LTD differ, these two categories are grouped together because it is problematic for most programs to differentiate between infants who did not receive services and those whose receipt of services was not reported (14). The survey also requests demographic data, such as infant's sex, maternal age, education, race, and ethnicity, for infants who were screened, diagnosed, and enrolled in early intervention. After consultation with representatives from the jurisdictional EHDI program, data were excluded if found to be incomplete or derived from estimated information because the survey requires that only nonestimated data be reported.

The rules and regulations related to newborn hearing screening vary by jurisdiction and birthing facilities and providers might or might not be required to report screening and follow-up data to their EHDI program. As a result, some jurisdictions were either not able to respond to the HSFS or were only able to provide limited data (e.g., only screening data). In addition, some responses were excluded because the data were incomplete or estimated. This resulted in screening data being available from at least 48 jurisdictions for 2005 and 49 jurisdictions for 2006, which in the United States accounted for approximately 3,431,884 (83%) of births in 2005 and 3,288,626 (77%) of births in 2006. Screening data were available from at least 50 jurisdictions for 2009, which accounted for more than 4,018,885 (97%) of births in the United States (15). Demographic data about maternal age, education, and race for infants screened for hearing loss

were available from at least 13 jurisdictions in 2009, which accounted for 699,637 (16.9%) of U.S. births. Screening data were available from at least 54 jurisdictions for 2010, which accounted for approximately 3,965,744 (99%) of U.S. births in 2010 (16). These same demographic data related to screening were available from at least 20 jurisdictions in 2010, which accounted for 947,831 (24%) of births (Table 2). Additional information about these data is available at www.cdc.gov/ncbddd/hearingloss/ehdi-data.html.

For the demographic data (Table 2), the percentage of infants diagnosed (i.e., hearing loss or no hearing loss) by maternal age was calculated by dividing the number identified with hearing loss plus the number reported with no diagnosed hearing loss (within each maternal age category) by the total number failing the hearing screening (within each maternal age category) multiplied by 100. The percentage of infants diagnosed (i.e., hearing loss or no hearing loss) by maternal education was calculated by dividing the number identified with hearing loss plus the number reported with no diagnosed hearing loss (within each maternal education category) by the total number failing the hearing screening (within each maternal education category) multiplied by 100. The percentage of infants diagnosed (i.e., hearing loss or no hearing loss) by maternal race/ethnicity was calculated by dividing the number identified with hearing loss plus the number reported with no diagnosed hearing loss (within each maternal race/ethnicity category) by the total number failing the hearing screening (within each maternal race/ethnicity category) multiplied by 100.

TABLE 2. Percentage of infants diagnosed after failed hearing screen, by maternal age,* education,† and race[§] — Hearing Screening and Follow-up Survey, United States, 2009–2010

Maternal characteristics	No. of infants that failed screening	% of infants diagnosed with normal hearing or hearing loss that failed screening
Maternal age (yrs)		
<15	47	27.7%
15–19	4,261	42.6%
20–24	10,766	45.4%
25–34	18,325	55.0%
35–50	5,011	59.0%
>50	7	57.1%
Maternal education		
Less than high school	8,176	45.0%
High school graduate or equivalent	10,607	48.8%
Some college	8,714	56.3%
College graduate or higher	6,556	71.1%
Maternal race[¶]		
White, non-Hispanic	22,816	57.0%
Black, non-Hispanic	6,606	44.7%
Asian	1,345	57.3%
NH and PI	515	23.7%
AI/AN	1,022	15.3%
Other	2,124	59.5%

Abbreviations: NH and PI: Native Hawaiian and Pacific Islander; AI/AN: American Indian/Alaska Native.

* Reporting jurisdictions for maternal age (yrs) for 2009: Arkansas, Colorado, Hawaii, Indiana, Massachusetts, Maine, Michigan, Minnesota, Missouri, Commonwealth of the Northern Mariana Islands, Montana, New Jersey, New Mexico, Rhode Island, South Dakota, Tennessee, Utah, Virginia, Washington, and Wyoming. Reporting jurisdictions for maternal age (yrs) for 2010: Arkansas, American Samoa, Colorado, Georgia, Guam, Hawaii, Iowa, Indiana, Kansas, Massachusetts, Maryland, Maine, Michigan, Commonwealth of the Northern Mariana Islands, Montana, North Carolina, New Jersey, New Mexico, Oregon, Palau, Rhode Island, South Dakota, Tennessee, Utah, Virginia, Washington, and Wyoming.

† Reporting jurisdictions for maternal education for 2009: Arkansas, Colorado, Indiana, Massachusetts, Maine, Michigan, Minnesota, Missouri, Commonwealth of the Northern Mariana Islands, Montana, New Jersey, New Mexico, Rhode Island, South Dakota, Tennessee, Utah, Virginia, and Vermont. Reporting jurisdictions for maternal education for 2010: Arkansas, Colorado, Georgia, Guam, Iowa, Indiana, Kansas, Massachusetts, Maine, Michigan, Commonwealth of the Northern Mariana Islands, Montana, New Jersey, New Mexico, Oregon, Palau, Rhode Island, South Dakota, Tennessee, Utah, and Virginia.

§ Reporting jurisdictions for maternal race for 2009: Arkansas, Colorado, Guam, Hawaii, Indiana, Massachusetts, Maine, Michigan, Minnesota, Commonwealth of the Northern Mariana Islands, Montana, New Jersey, New Mexico, Rhode Island, South Dakota, Tennessee, Utah, Virginia, and Vermont. Reporting jurisdictions for maternal race for 2010: Arkansas, American Samoa, Colorado, Georgia, Guam, Iowa, Indiana, Kansas, Massachusetts, Maine, Michigan, Commonwealth of the Northern Mariana Islands, Montana, North Carolina, New Jersey, New Mexico, Oregon, Palau, Rhode Island, South Dakota, Tennessee, Utah, Vermont, and Virginia.

¶ Persons of Hispanic ethnicity may be of any race or combination of races.

Results

During 2009–2010, a total of 7,796,448 (97.6%) of the approximately 8 million births in the jurisdictions responding to the HSFS were documented as having been screened for hearing loss. Of infants screened, 7,280,197 (93.4%) were screened before

age 1 month. A total of 58,567 (50.3%) of infants that failed the final hearing screening were documented as receiving a diagnosis (i.e., hearing loss or no hearing loss). Of those diagnosed, 41,119 (70.2%) were diagnosed before age 3 months. Of the infants failing the hearing screening, 49,109 (42.1%) were not documented to have a diagnosis and were LFU/LTD. A total of 6,795 (67.0%) of the approximately 10,000 infants with a diagnosed permanent hearing loss were documented as being enrolled in early intervention. Of those infants receiving intervention, 4,433 (65.2%) were enrolled before age 6 months. During 2005–2006, a total of 6,361,179 (94.7%) of the approximately 6.7 million infants born in the jurisdictions responding to the survey were documented as having been screened for hearing loss. Of these infants screened, 5,177,583 (81.4%) of infants were screened before age 1 month. A total of 40,715 (31.9%) of infants who failed the final hearing screening were documented as receiving a diagnosis. Of those diagnosed, 19,937 (49.0%) were diagnosed before age 3 months. Of the infants failing the hearing screening, 70,600 (55.4%) were not documented to have a diagnosis and were LFU/LTD. A total of 3,225 (56.5%) of the approximately 6,000 infants with a diagnosed permanent hearing loss were documented as being enrolled in early intervention. Of infants receiving intervention, 1,841 (57.1%) were enrolled before age 6 months. The improvements in the screening, diagnosis, and early intervention rates in 2009–2010, compared with 2005–2006, were statistically significant ($p < 0.05$ for all) (Table 1).

Although only a small number of jurisdictions were able to consistently provide complete demographic data, some trends are apparent. Data for 2009–2010 indicate that infants born to mothers aged 15–19 years are less likely to return for recommended follow-up services (43%) than infants born to mothers aged 35–50 years (59%). Infants born to mothers with less than a high school education were less likely to return for follow-up services than mothers with college degrees (45% vs. 71%). Additionally, some groups, such as Native Hawaiians and Pacific islanders (24%) and American Indians (15%), were less likely to return for follow-up services than Asians (57%), whites (57%), and blacks (44%) (Table 2). The differences within each demographic category were statistically significant ($p < 0.05$).

Discussion

Substantial progress has been made since 2005–2006 in identifying deaf and hard of hearing infants. This is reflected in the 2009–2010 data, which show that more infants received recommended screening, diagnostic, and early intervention services both overall and in accordance with the 1-3-6 benchmarks and the approximately 10,000 cases of hearing loss identified during this period. However, despite recent

progress, approximately 49,000 (42.1%) U.S. infants were not documented as receiving recommended follow-up services after failing a screening, and therefore were classified as LFU/LTD. Although additional data are needed before conclusive opinions can be drawn, the 2009–2010 demographic data indicate that some groups (e.g., young mothers, certain racial groups, and mothers with low educational attainment) are more likely to have infants that become LFU/LTD.

Without the timely receipt of recommended follow-up services, the benefits of newborn hearing screening can be severely diminished. The importance of follow-up and early identification is underscored by research from England, which found that total education expenditures for children with hearing loss was 22% lower among those screened at birth than those who were not offered a newborn hearing screening (17,18). The progress made from 2005–2006 to 2009–2010 towards providing recommended services to infants occurred in conjunction with increased collaboration and adoption of evidence-based strategies by clinical care providers and EHDI programs. The successful implementation of these strategies and collaborations were the result of efforts by federal agencies (e.g., CDC, Health Resources and Services Administration (HRSA), and USPSTF), SACHDNC, jurisdictional EHDI programs, clinical service providers, families, and professional organizations (i.e., the American Academy of Audiology, the American Academy of Otolaryngology-Head and Neck Surgery, the American Academy of Pediatrics [AAP], and the American Speech-Language-Hearing Association).

To achieve further reductions in LFU/LTD, additional efforts are required so that providers can more efficiently coordinate and document the receipt of follow-up services. This can be achieved by improving existing clinical and public health infrastructures and leveraging opportunities in emerging areas, such as health information technology (HIT) (19). Standardization and adoption of HIT, including Electronic Health Records (EHR) and clinical decision support tools, can improve the exchange of clinical data between health-care providers and public health programs. This improved exchange of information can help increase awareness about the need for follow-up among all of a patient's providers and ensure that infants who are deaf and hard of hearing are identified as early as possible. The benefits of HIT are supported by findings that have shown EHR technology can improve the quality of care and assist providers in delivering services more efficiently when properly used. In addition, the efficacy of HIT in improving the efficiency of health care has been demonstrated (20,21,22).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to

collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (23). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (24); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (25); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP (26) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (27); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (28). Hearing screening is recommended by USPSTF as a Grade B service for all newborn infants (3). The Bright Futures guidelines recommend hearing screening and appropriate follow-up for all infants at multiple points as the child ages (10,26). State Medicaid programs cover hearing screening, diagnosis, and intervention as part of the Early and Periodic Screening, Diagnostic and Treatment benefit.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.* Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including recommended hearing screening. Monitoring within the medical home and additional hearing screenings during early childhood and in school aged populations is recommended by JCIH and AAP. This is a result of the increasing prevalence of hearing loss throughout childhood from the additions of late-onset, late identified, and acquired hearing loss (11,29).

Limitations

The findings in this report are subject to at least five limitations. First, some jurisdictions either did not respond to HSFS or were only able to provide limited data in one or more reporting years. This includes instances where some jurisdictions were either not

*The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

able to report any demographic data or were only able to provide a few of the requested data items. As a result, differences existed in the number of jurisdictions reporting data in the periods 2005–2006 and 2009–2010. Second, although data collection is standardized across jurisdictions, HSFS data are voluntarily reported and subject to inaccuracies. Third, the data reported only reflect services that infants were documented to have received. Because the rules related to the reporting of newborn hearing screening, diagnostic, and intervention data vary by jurisdiction, the percentage of infants receiving recommended services might be higher than what is being reported. Fourth, information about the health insurance and socioeconomic status of families of infants is not available through HSFS. Therefore it is not possible to assess if and to what extent these factors contribute to LFU/LTD. Finally, the data from 2009–2010 are now more than 3 years old and do not reflect recent progress within jurisdictions.

Conclusion

The universal and timely provision of newborn hearing screening and recommended diagnostic and early intervention services makes it possible to assist infants who are deaf and hard of hearing to be identified early and able to reach their full potential. However, sustained efforts are needed to ensure infants receive recommended follow-up services. If available health information technologies are adopted by providers and public health programs, service coordination can improve between public health and early intervention providers, and implementation of health-care reform increases the number of infants with access to health care, there will be a substantial and lifelong effect on the outcome for all infants who are deaf and hard of hearing and their families in the U.S. population.

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Screening for Developmental Delays Among Young Children — National Survey of Children's Health, United States, 2007

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Introduction

Early childhood development typically follows a trajectory of achieving physical, cognitive, communication, social-emotional, and self-help milestones within a specified age range. Although most children reach these milestones within a similar range, others exhibit mild to severe developmental delays that indicate potential developmental disabilities. Developmental disabilities are a group of conditions caused by an impairment in one or more developmental domains (e.g., physical, learning, communication, behavior, or self-help). Developmental disabilities can become evident during the prenatal period through age 22 years, affect day-to-day functioning, and usually are lifelong (1). Approximately 15% of children aged 3–17 years in 2008 were estimated to have developmental disabilities of varying severity, such as language or learning disorders, intellectual disabilities, cerebral palsy, seizures, hearing loss, blindness, autism spectrum disorder* (ASD), or other developmental delays (2).

The causes of most developmental disabilities are unknown, and primary interventions are rare. Ongoing research seeks to clarify the etiologies. A current public health priority is to use early interventions to reduce, and ideally prevent, the occurrence and severity of long-term functional limitations (1). For children who have developmental delays, early interventions such as developmental behavioral therapies can improve development in many areas such as language and communication (3,4), cognitive (5), and social-emotional (5,6) areas. Families participating in early

interventions are able to better meet their children's specific needs throughout their lives (7), and society benefits from a decreased need for later costly special education services (8). Despite the benefits of early intervention, many children's developmental delays are not identified early enough for the children to benefit optimally from these interventions. Only 2%–3% of all children receive public early intervention services by age 3 years, compared with approximately 15% who are estimated to have a developmental disability during childhood (9,10).

The process of early identification requires health-care providers to be aware of developmental milestones and implement informal and formal developmental probes as part of routine well-child checks. The use of validated developmental and behavioral screening tools, including questionnaires asking a parent or caregiver questions about the development of their child at specific ages (11,12) or when a concern exists, is important. Without routine screening, only an estimated 30% of children with developmental issues are identified before they reach kindergarten (13). Children at risk for delays who are screened are more likely to receive early intervention services than unscreened peers who are at high risk for delays (14). Parent-reported use of questionnaires for developmental screening by health-care providers has been reported to be 19.5% for children aged ≤5 years (14). Pediatricians have reported higher rates (47.7%) of use of a standardized developmental screening tool (15). However, rates increase to 80% when a focused effort is made to increase the use of developmental screening in pediatric practice (16).

A key example of the important role of public health in developmental screening and early identification of developmental disabilities is highlighted by an increase of 120% in the identified prevalence of ASD in multiple U.S. communities from 2002 to 2010 (17). The identified prevalence of ASD is estimated to be 1%–2% of children

*ASD is a developmental disability characterized by atypical development in social interaction and communication and the presence of restricted and repetitive behaviors and interests. Symptoms of ASD typically are present before age 3 years and often are accompanied by unusual patterns in cognitive functioning, learning, attention, and sensory processing. ASD includes conditions that were previously diagnosed as autistic disorder, Asperger disorder, or pervasive developmental disorder—not otherwise specified.

aged 3–17 years (17,18). Persons with ASD typically require substantial support throughout life, and early developmental behavioral therapy for young children with ASD can improve language, cognitive, and adaptive skills (19), with increased benefits from earlier and more intensive interventions (20). Parental or professional concerns about development in children with ASD are common before age 2 years; however, most children do not receive the diagnosis until after age 4 years (17). By age 3 years, only 44% of children identified with ASD had received a comprehensive evaluation, despite documentation of developmental concerns among 89% of the children. By age 8 years, 20% of children with ASD have not received a documented ASD diagnosis or special education classification (17). Although lack of a specific diagnosis does not necessarily preclude the child from receiving special support services, identification of a developmental delay or concern is essential for the family to receive appropriate interventions, and the diagnosis can help clarify the specific needs of the child.

Several national organizations and programs have developed guidelines and quality care indicators for early surveillance, screening, and identification of developmental concerns or delays. The American Academy of Pediatrics (AAP) recommends 1) developmental surveillance (also referred to as developmental monitoring) at every pediatric preventive care visit through the age of 5 years; 2) general developmental screening using a validated screening tool for all children at age 9, 18, and either 24 or 30 months; and 3) autism-specific screening for all children at 18 and either 24 or 30 months (21). This recommendation has been included in *Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents* (22). The National Quality Forum (NQF) is a partnership of government and nongovernment agencies to set standards for improving the quality of health care. NQF has endorsed measures for developmental screening for children from birth through age 5 years (NQF #1385, #1399, and #1448) as indicators of effective and timely population health services (23). In addition, *Healthy People 2020* includes an objective of the percent of children aged 10–35 months who are screened for an ASD and other developmental delays within the previous year (objective MICH-29.1) (24).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in

this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (25). This report analyzes 2007 data from the National Survey of Children's Health (NSCH) to estimate the percentage of children aged 10–47 months who were screened for developmental disabilities based on parental reports of physician ordered, parent-completed questionnaires and those who were monitored according to parental reports of physicians asking about parental concerns. The focus on parent-completed developmental questionnaires corresponds with the AAP recommendations and evidence supporting the validity of parent-reported developmental screening (12,13,22). Public health professionals and clinicians can use these data to identify population groups that might require additional strategies to access developmental screening preventive services.

Methods

CDC analyzed 2007 data from NSCH to estimate the prevalence of physician-ordered developmental screening completed by a parent (referred to as developmental screening—parent-completed, or DS-PC) and the prevalence of parents reporting that a physician or health-care provider asked whether they had any concerns about their child's learning (referred to as developmental monitoring by a health-care provider, or DM-HCP) in the past 12 months for children aged 10–47 months. NSCH is conducted by CDC as part of the State and Local Area Integrated Telephone Survey, with funding and direction from the Maternal and Child Health Bureau of the Health Resources and Services Administration (HRSA) (26). NSCH is a random-digit-dial survey that provides national and state-specific information on the health and well-being of children aged <18 years based on interviews with a parent or guardian (referred to as parents in this report). Within each household, one child was randomly selected to be the subject of the interview. Interviews were completed during April 2007–July 2008 for 91,642 children. The overall interview completion rate was 66.0%, and the overall response rate (denominator includes telephone calls that were not answered) was 46.7%. All estimates from NSCH are adjusted for nonresponse and weighted to represent the noninstitutionalized civilian U.S. population of children. Although 2011–2012 NSCH data were available for analysis, 2007 data were analyzed because they represent baseline estimates before the implementation of most national health-care reform provisions.

NSCH records the age of the child in months for children aged <24 months and in years for children aged 2–17 years.

Data were analyzed for children aged 10 months through 3 years (up to 47 months). The resulting age range of 10–47 months ($n = 13,485$) corresponds to the AAP developmental screening guidelines and the *Healthy People 2020* objective MICH-29.1 (24). A child was considered to have received a parent-completed developmental screening (DS-PC) if the parent answered “yes” to three age-specific questions designed to capture the use of a standardized screening tool about their child’s developmental, communication, or social behaviors (27). To measure DS-PC, participants from the 2007 NSCH (regarding children aged 10–71 months) were asked, “Sometimes a child’s doctor or other health-care provider will ask a parent to fill out a questionnaire at home or during their child’s visit. During the past 12 months, did a doctor or other health-care provider have you fill out a questionnaire about specific concerns or observations you may have about (Specific Child)’s developmental, communication or social behaviors?” If their response was “yes,” participants were asked two follow-up questions depending on the child’s age. For children aged 10–23 months: “Did this questionnaire ask about your concerns or observations about how (Specific Child) talks or makes speech sounds?” and “Did this questionnaire ask about your concerns or observations about how (Specific Child) interacts with you and others?” For children aged 24–71 months: “Did this questionnaire ask about your concerns or observations about words and phrases (Specific Child) uses and understands?” and “Did this questionnaire ask about your concerns or observations about how (Specific Child) behaves and gets along with you and others?” The survey also included a more general question about developmental monitoring. A child was considered to have received developmental monitoring (DM-HCP) if parents reported that a physician or health-care provider asked whether they had any concerns about their child’s learning, development, or behavior. To measure developmental surveillance (monitoring), participants from the 2007 NSCH (regarding children aged 10–71 months) were asked, “During the past 12 months did (Specific Child)’s doctors or other health care providers ask you if you have concerns about [his/her] learning, development, or behavior?” Demographic variables, the child’s health status, insurance adequacy and coverage, availability of a medical home, and concerns about development were based on parent report according to NSCH 2007 definitions (26). Region and metropolitan statistical area status were based on U.S. Census Bureau definitions (28). Data were analyzed using statistical software to account for the complex sample design, and 95% confidence intervals were calculated. Two-tailed chi-square tests were used to assess differences in receipt of DS-PC by demographic, health-care, and concern variables. Differences were considered significant at $p < 0.05$.

Results

In 2007, parents of 21.1% of children aged 10–47 months reported that they had been asked to fill out a questionnaire by a health-care provider about their child’s developmental, communication, or social behaviors (DS-PC) in the past 12 months (Table 1). The percentage screened was significantly higher (22.6%) for the youngest (10–35 months) age group, children whose primary language in the household was English (21.9%) ($p < 0.05$), and in the South (24.5%; $p < 0.01$) compared with their respective groups. No statistically significant differences were found by sex, race or ethnicity, family structure, parental education, household income, or metropolitan statistical area. Children with special health-care needs (29.4%) and those reported to have at least one of the 16 chronic conditions (27.6%) were screened more frequently than those without special health-care needs (20.1%) or none of the 16 conditions (20.3%; $p < 0.01$) (Table 2). DS-PC was lowest among children reported to have had no insurance in the past year (9.0%; $p < 0.01$), without a medical home (18.8%; $p < 0.05$), and who were not receiving family-centered care (16.9%; $p < 0.01$). No statistically significant differences were found based on ratings of the child’s health insurance source (public or nonpublic only).

Although the prevalence of formal DS-PC was low (21.1%), a much higher percentage (52.3%) of children were reported to have health-care providers who engaged in developmental monitoring by informally asking about parental concerns about the child’s learning, development, or behavior (DM-HCP) (Table 3). Either DS-PC or DM-HCP monitoring was reported for 42.7% of the children, both DS-PC and DM-HCP were reported for 15.4%, and neither type of monitoring was reported for 42.0% of children. Reports of DS-PC or DM-HCP were similar regardless of the parent report of concerns or risk for developmental delay.

Discussion

The results in this report indicate that despite recommendations that all children be screened for developmental delays by health-care providers at 9, 18, and either 24 or 30 months and for ASD at 18 and either 24 or 30 months (22), the parents of only 21.1% of children aged 10–47 months reported in 2007 that they were asked by a health-care provider to complete a developmental screening tool concerning their child’s development in the past year. The prevalence of physician-ordered, parent-completed developmental screening was low regardless of demographic, health-care, or risk indicators. Developmental monitoring was reported for 52.3% of

children in the past year, indicating that health-care providers are more likely to use informal discussions and questions about parental concerns related to learning, development, or behavior than they are to use parent-report questionnaires.

However, indications of a parental concern or risk for a developmental delay did not result in additional screening for those children. This type of informal monitoring is less likely to result in appropriate identification of children with

TABLE 1. Percentage of children aged 10–47 months with a physician-ordered, parent-completed developmental screening in the past 12 months, by demographic characteristics* — National Survey of Children's Health, United States, 2007

Characteristic	Unweighted sample size [†]	% screened [§]	(95% CI)
Age (months)[¶]			
10–35	9,092	22.6	(20.8–24.6)
10–23	5,370	23.1	(20.8–25.6)
24–35	3,722	22.0	(18.9–25.4)
36–47	4,393	17.7	(15.2–20.6)
Sex			
Male	6,998	20.8	(18.7–23.0)
Female	6,479	21.5	(19.2–23.9)
Race/Ethnicity			
White, non-Hispanic	8,778	20.4	(18.5–22.3)
Black, non-Hispanic	1,129	24.5	(20.4–29.0)
Hispanic	1,950	19.8	(16.3–24.0)
Multiple race, non-Hispanic	760	23.9	(15.4–35.2)
Other single race, non-Hispanic	669	26.7	(19.8–35.0)
Primary language in household[¶]			
English	12,157	21.9	(20.2–23.7)
Language other than English	1,319	16.5	(13.3–20.4)
Family structure			
Two parents	11,190	20.3	(18.6–22.1)
Single mother, no father present	1,777	25.7	(21.7–30.2)
Other family structure	451	21.8	(14.7–31.2)
Educational attainment			
Less than high school	752	24.3	(18.4–31.2)
High school graduate	1,804	19.9	(16.4–24.0)
Some college or greater	10,702	21.5	(19.7–23.3)
Income relative to federal poverty guidelines			
<100%	1,945	22.6	(19.3–26.4)
100 to <200%	2,351	22.5	(18.9–26.7)
200 to <400%	4,357	20.6	(18.1–23.5)
≥400%	4,832	19.4	(16.6–22.5)
Region^{**}			
Northeast	2,289	13.4	(10.9–16.3)
Midwest	3,144	23.7	(21.2–26.4)
South	4,545	24.5	(21.9–27.3)
West	3,507	18.2	(14.8–22.3)
Metropolitan statistical area status			
Yes	10,214	20.7	(19.0–22.5)
No	3,271	23.3	(20.1–26.9)
Total	13,485	21.1	(19.6–22.7)

Abbreviation: CI = confidence interval.

* Demographic variables were based on parent report of the child's age, sex, race, ethnicity, primary language spoken in the home, family structure, highest educational attainment of any parent in the household, and household income relative to federal poverty guidelines. Region and metropolitan statistical area status were based on U.S. Census Bureau definitions.

[†] Certain demographic variables might not add up to 13,485 because of missing data.

[§] The numerator is the number of children with "yes" response to three questions. All parents were asked: "Sometimes a child's doctor or other health-care provider will ask a parent to fill out a questionnaire at home or during their child's visit. During the past 12 months, did a doctor or other health-care provider have you fill out a questionnaire about specific concerns or observations you may have about (Specific Child)'s developmental, communication or social behaviors?" To adjust for developmental appropriateness, parents of children aged 10–23 months who responded "yes" to the previous question were asked the following two additional questions: "Did this questionnaire ask about your concerns or observations about how (Specific Child) talks or makes speech sounds?" and "Did this questionnaire ask about your concerns or observations about how (Specific Child) interacts with you and others?" Parents of children aged 24–71 months who responded "yes" were asked two similar but developmentally appropriate questions: "Did this questionnaire ask about your concerns or observations about words and phrases (Specific Child) uses and understands?" and "Did this questionnaire ask about your concerns or observations about how (Specific Child) behaves and gets along with you and others?" The denominator is the number of children with no missing data for the preceding questions.

[¶] $p < 0.05$.

** $p < 0.01$.

TABLE 2. Percentage of children aged 10–47 months with a physician ordered, parent-completed developmental screening in the past 12 months, by selected measures of health status, health-care access, and use* — National Survey of Children’s Health, United States, 2007

Characteristic	Unweighted sample size [†]	% screened [§]	(95% CI)
Child’s health status*			
Excellent or very good	12,096	21.0	(19.4–22.8)
Good	1,129	20.0	(15.7–25.1)
Fair or poor	257	30.0	(21.8–39.6)
Child has special health-care needs^{¶,***}			
Yes	1,562	29.4	(24.8–34.5)
No	11,923	20.1	(18.5–21.8)
Child has one or more of 16 chronic health conditions^{¶,††}			
Yes	1,311	27.6	(22.9–32.8)
No	12,174	20.3	(18.7–22.1)
Child’s health insurance coverage and source			
Insured	12,608	21.5	(19.9–23.1)
Public insurance	3,521	23.2	(20.5–26.2)
Nonpublic insurance only	9,000	20.5	(18.5–22.6)
Uninsured	853	17.1	(12.4–23.2)
Health insurance continuity and adequacy^{¶,§§}			
Continuous and adequate coverage	9,764	22.3	(20.5–24.3)
Continuous but inadequate coverage	2,122	20.0	(16.2–24.3)
Periods without insurance during past year	1,282	18.2	(14.0–23.5)
No insurance in past year	259	9.0	(5.3–14.9)
Medical home status^{§§,¶¶}			
Has medical home	8,977	22.5	(20.5–24.6)
No medical home	4,138	18.8	(16.5–21.3)
Receipt of family-centered care[¶]			
Yes	10,363	22.5	(20.6–24.5)
No	2,986	16.9	(14.5–19.7)
Total	13,485	21.1	(19.6–22.7)

Abbreviation: CI = confidence interval.

* The child’s health status was based on the parent’s description of the child’s overall health as excellent, very good, good, fair, or poor. The Children with Special Health-Care Needs Screener was used to identify children with special health-care needs based on the Maternal and Child Health Bureau definition. For children with current coverage, adequacy of health insurance was based on parent report that the health insurance usually or always offers benefits and covers services that meet the child’s needs, allows the child to see needed health-care providers, and has reasonable out-of-pocket costs within the past year. (Source: Kogan MD, Blumberg SJ, Schieve LA, et al. Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the U.S., 2007. *Pediatrics* 2009;124:1395–403.)

† Certain demographic variables might not add up to 13,485 because of missing data.

§ The numerator is the number of children with “yes” response to three questions. All parents were asked: “Sometimes a child’s doctor or other health-care provider will ask a parent to fill out a questionnaire at home or during their child’s visit. During the past 12 months, did a doctor or other health-care provider have you fill out a questionnaire about specific concerns or observations you may have about (Specific Child)’s developmental, communication or social behaviors?” To adjust for developmental appropriateness, parents of children aged 10–23 months who responded “yes” to the previous question were asked the following two additional questions: “Did this questionnaire ask about your concerns or observations about how (Specific Child) talks or makes speech sounds?” and “Did this questionnaire ask about your concerns or observations about how (Specific Child) interacts with you and others?” Parents of children aged 24–71 months who responded “yes” were asked two similar but developmentally appropriate questions: “Did this questionnaire ask about your concerns or observations about words and phrases (Specific Child) uses and understands?” and “Did this questionnaire ask about your concerns or observations about how (Specific Child) behaves and gets along with you and others?” The denominator is the number of children with no missing data for the preceding questions.

¶ $p < 0.01$.

*** Children are identified based on parent report of an ongoing health condition for which the children experience one or more of the following: 1) need or use of prescription medications; 2) an above routine use of services; 3) need or use of specialized therapies or services; 4) need or use of mental health counseling; or 5) a functional limitation (Source: Blumberg SJ, Foster EB, Frasier AM, et al. Design and operation of the National Survey of Children’s Health, 2007. Rockville, MD: National Center for Health Statistics, CDC.)

†† Questions about 16 chronic health conditions also were included in the National Survey of Children’s Health: learning disability, attention deficit hyperactivity disorder, depression, anxiety problems, behavioral or conduct problems, autism or other autism spectrum disorder, developmental delay, speech problems, asthma, diabetes, Tourette syndrome, epilepsy or seizure disorder, hearing problems, vision problems, bone or joint problems, and brain injury or concussion. Questions about current (at the time of the interview) health insurance coverage and source were followed by questions about gaps in coverage during the past 12 months (to assess continuity) (Source: Blumberg SJ, Foster EB, Frasier AM, et al. Design and operation of the National Survey of Children’s Health, 2007. Rockville, MD: National Center for Health Statistics, CDC.)

§§ To qualify as having a medical home, children must have a personal physician or nurse, a usual source for care (other than the emergency department), family-centered care, and no problems obtaining needed referrals, and their parents must usually or always get any needed help arranging or coordinating care (Sources: Kogan MD, Blumberg SJ, Schieve LA, et al. Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the U.S., 2007. *Pediatrics* 2009;124:1395–403; Medical Home Initiatives for Children With Special Needs Project Advisory Committee, American Academy of Pediatrics. The medical home. *Pediatrics* 2002;110:184–6.)

¶¶ $p < 0.05$, two-tailed chi-square test.

TABLE 3. Percentage of children aged 10–47 months with a physician-ordered, parent-completed developmental screening and with developmental monitoring of parental concerns in the past 12 months, by selected measures of parental concern — National Survey of Children's Health, United States, 2007

Measure of parental concern	Unweighted sample size*	% screened	(95% CI)
Child had a physician-ordered, parent-completed developmental screening	13,485	21.1	(19.6–22.7)
Number of concerns parent has about child's learning, development, or behavior [†]			
None	8,400	21.2	(19.2–23.3)
One or more	5,085	21.0	(18.6–23.5)
Risk for developmental delay (based on parent report of concerns on PEDS) [†]			
No or low risk	10,308	20.6	(18.8–22.5)
Moderate or high risk	3,177	22.6	(19.8–25.6)
Physician or other health-care provider asked about parent's concerns[§]	13,680	52.3	(50.2–54.4)
Number of concerns parent has about child's learning, development, or behavior			
None	8,537	53.5	(50.8–56.2)
One or more	5,143	50.5	(47.2–53.8)
Risk for developmental delay (based on parent report of concerns on PEDS)			
No or low risk	10,458	52.7	(50.2–55.1)
Moderate or high risk	3,211	51.4	(47.3–55.4)
Child had a physician-ordered, parent-completed developmental screening or physician asked about concerns	13,364	42.7	(40.6–44.8)
Child had a physician-ordered, parent-completed developmental screening and physician asked about concerns	13,364	15.4	(14.0–16.8)
Child did not have a physician-ordered, parent-completed developmental screening and physician did not ask about concerns	13,364	42.0	(39.8–44.1)

Abbreviations: CI = confidence interval; PEDS = Parents' Evaluation of Developmental Status.

* Certain demographic variables might not add up to 13,485 because of missing data.

[†] Parent concerns about development were indicated by responding affirmatively to at least one of nine concerns about the child's learning, development, or behavior, and the responses to these nine concerns were combined to form an assessment of risk for developmental delay based on PEDS scoring criteria for surveys.

[§] Parents also were asked whether a physician or health-care provider asked them about concerns about their child's learning, development, or behavior (developmental monitoring).

developmental delays (9). As of 2007, only one in five children were reported to have met national standards for quality health care specified by NQF targeted by *Healthy People 2020* for universal developmental screening of all young children in pediatric health-care settings.

Potential reasons for the low percentage of requests from health-care providers for parents to complete developmental screening questionnaires include overreliance by health-care providers on their own clinical judgment, limited trust in parental report, and use of informal checklists rather than validated screening tools (9,29). Despite parent reports of infrequent developmental screening, almost half (47.7%) of pediatricians report using a standardized developmental screening tool (15). Although the difference between parents and pediatricians in reporting developmental screening might reflect the use of other, less common developmental screening methods among physicians (e.g., examination or interview), this difference also might indicate the need for improved communication between health-care professionals and caregivers when developmental screening is actually occurring. Pediatric health-care providers cite lack of time, cost, reimbursement uncertainty, insufficient training, overidentification concern, and limited knowledge or availability of referral options for follow-up assessments and services as concerns related to incorporating developmental screening into their practice (9,29,30). Physicians who initiate

screening should be prepared to act (i.e., provide a referral) if a concern is identified during the screening process; a referral for early intervention might be unnecessarily deferred if a physician waits for formal diagnostic results (31). Because a diagnosis is not a requirement for referral for certain services and supports, including those covered under the Individuals with Disabilities Education Act, referral options might not be as limited as pediatricians believe (32). Several studies have shown that validated screening tools are an effective means of identifying children who are likely to have developmental delays and that approximately 70% of children whose screening results indicate a concern for a developmental disorder but do not meet the criteria for a specific delay still have substantial developmental delays that necessitate support services (33). Parent-report screening tools can provide valid and reliable screening information and are cost-effective with minimal added administration costs (11,33,34). In addition, several studies have shown that perceived barriers can be successfully addressed and that integration of quality developmental screening in pediatric practices is feasible (15,35).

Programs are underway that might increase the use of developmental and ASD screening in health-care settings (29). These efforts include public health programs such as CDC's "Learn the Signs. Act Early." program to improve awareness of typical child developmental milestones and indicators of developmental concern and encourage parents, health-care

providers, and early educators to engage in developmental monitoring (36). CDC, HRSA, the Association for University Centers on Disabilities, and the Association of Maternal and Child Health Programs have worked together to support Act Early Initiatives, including state plans, personnel training, and programs to improve early identification (37). HRSA and AAP also supports efforts such as the Bright Futures Guidelines to prepare health professionals to use valid and reliable screening tools and develop systems of care that screen early, link to services, and develop medical homes for children with ASD and other developmental disabilities (38). Early identification and linkage to appropriate services and support services is a process that requires developmental monitoring and screening at key points during childhood development; however, these activities should occur in the context of a medical or health home (39). This position is reflected in programs such as Bright Futures and others that involve coordinated systems of care, such as Project LAUNCH projects aimed at improving service systems for the health and well-being of young children (40).

Integrating developmental monitoring and screening as components in electronic health records offers the opportunity to increase accessibility and use of these important tools for improving early identification (41). To date, the NQF health-care quality clinical measures for screening have been endorsed but have not been approved for the staged integration into electronic health records (42). The cost of screening tools and the permissions needed to integrate them into electronic systems present barriers to routine clinical use. Because of these challenges, public-domain screeners that have been well-validated in the general population could be used to address some of these challenges. Meanwhile, access to disability and behavioral services is expanding in the health-care field. For example, in 2012, the Office of Personnel Management reclassified Applied Behavior Analysis for children with ASD from an educational intervention to an approved medical therapy that can be covered under the federal employee health benefits program (42). However, access and coverage of developmental behavioral health interventions vary substantially based on state interpretation of the essential health benefits (43).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (44). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including

1) recommended services of the U.S. Preventive Services Task Force graded A (strongly recommended) or B (recommended) (45); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (46); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP (22) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (47); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (48). The Bright Futures guidelines recommend developmental monitoring and screening at multiple points as the child ages, including developmental monitoring from birth through age 21 years and developmental screening when the child is aged 9, 18, and either 24 or 30 months (21). State Medicaid programs cover developmental monitoring and screening as part of the Early and Periodic Screening, Diagnostic, and Treatment benefit.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.* Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including developmental monitoring and screening.

The analysis in this report includes the use of a large, nationally representative population sample from NSCH to provide an estimate for developmental screening and monitoring before passage of ACA in 2010. Updated estimates from the 2011–2012 NSCH indicate some increases in developmental screening; however, many children are not receiving screening (27).

Limitations

The findings in this report are subject to at least five limitations. First, NSCH excludes children who live in institutions, although this accounts for a small proportion of children (28). Second, responses are likely to be subject to coverage and nonresponse biases because NSCH contacts respondents using landline telephones rather than cellular

*The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

telephones. Third, the estimates are based on parental report and are subject to recall bias and differential interpretation of the questions. Fourth, separate screening rates for ASD and developmental delays were not reported because questions regarding diagnosis of an ASD or other developmental delay were only applicable to children aged >2 years, and children with undiagnosed conditions were not identified. Finally, because age is recorded in years rather than months for children aged ≥ 2 years, responses to the question about whether the child has been screened in the past 12 months do not allow for analyses that match the specific ages of the AAP screening recommendations. However, the sample of children aged 10–47 months in the study includes the appropriate AAP and *Healthy People 2020* age ranges for recommended developmental screening.

Conclusion

Early identification of developmental delays among young children is an important first step in providing the opportunity for children to receive early intervention services to increase functional skills. Parents of 21% of children reported being asked to complete a questionnaire about their child's development, indicating low use of validated screening tools. Although parents of twice as many children were informally asked about concerns they might have had about their child's learning, development, or behavior, this type of informal monitoring is less likely to result in appropriate identification of children with developmental delays. Substantial opportunities exist to help monitor the development of children in the United States, such as the use of protocols for developmental monitoring and the use of validated developmental screening tools as part of coordinated systems of health care.

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Lead Screening and Prevalence of Blood Lead Levels in Children Aged 1–2 Years — Child Blood Lead Surveillance System, United States, 2002–2010 and National Health and Nutrition Examination Survey, United States, 1999–2010

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Introduction

Lead poisoning in children is preventable. However, in 2010, a total of 34 U.S. states and the District of Columbia (DC) identified approximately 24,000 children aged <6 years with blood lead levels (BLLs) ≥ 10 $\mu\text{g}/\text{dL}$ and approximately 243,000 children aged <6 years with BLLs ≥ 5 $\mu\text{g}/\text{dL}$, the upper reference range value* established in 2012 for follow-up blood lead testing in children aged 0–6 years (1). Permanent neurologic damage and behavior disorders have been associated with lead exposure even at detectable BLLs < 5 $\mu\text{g}/\text{dL}$ (2–5).

In 1991, CDC recommended that identification of children with BLLs ≥ 10 $\mu\text{g}/\text{dL}$ should prompt public health action by state or local health departments with follow-up testing (6). In 2012, CDC's Advisory Committee for Childhood Lead Poisoning Prevention (ACCLPP) recommended that CDC shift its priorities to primary prevention. ACCLPP provided additional guidance to clinicians related to the follow-up of children with BLLs of 5–10 $\mu\text{g}/\text{dL}$ on the basis of evidence that these levels are associated with IQ deficits, attention-related behaviors, and poor academic achievement (7–10). ACCLPP also recommended using a reference range value based on the estimated 97.5 percentile of the BLL distribution among children aged 1–5 years calculated from two 4-year cycles of National Health and Nutrition Examination Survey (NHANES) data. In 2010, the upper value of the reference range was 5 $\mu\text{g}/\text{dL}$.

The Bright Futures guidelines, adopted by the American Academy of Pediatrics (AAP) in 1998 and endorsed by the Health Resources and Services Administration (HRSA) recommend that a clinical risk assessment for lead exposure be performed for infants (at ages 6 and 9 months), with blood lead

testing to follow if positive. The assessment includes questions about Medicaid eligibility and living in housing built before 1978. The Bright Futures guidelines also recommend that children who are enrolled in Medicaid or living in high-risk areas as defined by the state or local health departments be screened for lead at ages 12 and 24 months (11). The National Committee for Quality Assurance has established a specific Healthcare Effectiveness Data and Information Set measure (i.e., the percentage of children who had one or more capillary or venous blood test for lead poisoning by their second birthday) (12). Because lead risk varies across the United States, the most recent CDC lead screening recommendations urge state and local health departments to assess local data on lead risks as the basis for developing lead screening recommendations for health-care providers that target children at risk in their areas, focusing on children aged 1–2 years (13).

Several risk factors are associated with lead exposure. The most common risk factor is living in a housing unit built before 1978, the year when residential use of lead paint was banned in the United States. If a child is identified as having a BLL ≥ 5 $\mu\text{g}/\text{dL}$, ACCLPP recommends further assessment of the child and the home environment, follow-up treatment, and retesting the child's BLL until it has decreased to either < 5 $\mu\text{g}/\text{dL}$ or < 10 $\mu\text{g}/\text{dL}$, depending on the state's guidelines (7). Follow-up treatment will vary depending on the child's BLL but might include health education, environmental investigations of the home or other places the child frequents, and chelation therapy (13). Data from state and local blood lead surveillance programs also can guide targeted primary prevention activities that control or eliminate lead sources before children are exposed and highlight geographic areas and special subpopulations (e.g., refugee populations) for which the risk for lead poisoning is greatest. A *Healthy People 2020* objective (objective EH-8.2) is to reduce the mean BLLs in children aged <6 years by 10% (14). The baseline

*An upper reference range value is used to identify persons whose exposure to a toxic substance is higher than that of most persons in the population and useful in instances when no clear threshold for effects has been identified

level is 1.5 $\mu\text{g}/\text{dL}$, and the goal is 1.4 $\mu\text{g}/\text{dL}$. Another *Healthy People 2020* objective (objective EH-8.1) is to eliminate BLLs $\geq 10 \mu\text{g}/\text{dL}$ in the same population (14).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (15). This report analyzes 2002–2010 data from CDC's Child Blood Lead Surveillance (CBLs) System to determine the proportion of U.S. children aged 1–2 years who were tested for lead. State and local health departments have their own definitions of the criteria for identifying children who are at risk, with a focus on children aged 1–2 years. However, because a single national definition of children at risk does not exist, establishing the screening rate of children at risk is not possible. This report also analyzes 1999–2010 data from NHANES to examine prevalence of BLLs $\geq 5 \mu\text{g}/\text{dL}$ and $\geq 10 \mu\text{g}/\text{dL}$ among children aged 1–2 years over time by factors that historically have predicted the risk for BLLs at or above the current reference value. Public health authorities and clinicians can use these data to identify population subgroups with suboptimal screening rates and target prevention tactics.

Methods

To estimate the proportion of children aged 1–2 years who were tested for lead, CDC analyzed 2002–2010 data from CBLs, and to calculate the prevalence of BLLs $\geq 5 \mu\text{g}/\text{dL}$ and $\geq 10 \mu\text{g}/\text{dL}$ among children aged 1–2 years, CDC analyzed data from three 4-year intervals of NHANES (1999–2002, 2003–2006, and 2007–2010). Using 4-year intervals provided a greater number of children tested and yielded more stable estimates. CDC recommends that state and local departments should identify children at high risk for BLLs $\geq 5 \mu\text{g}/\text{dL}$ and provide access to screening for lead, focusing on children aged 1–2 years (8). Regardless of whether they were obtained from children at high risk, all qualified blood lead tests (defined as having certain information for completeness [i.e., date of birth, blood lead level, and date of blood lead test]) are reported to CBLs. During 2002–2010, the number of state and local health departments reporting BLLs to CBLs ranged from 36 to 44. Annual screening rates were calculated by dividing the

number of children aged 1–2 years with a valid blood test in CBLs for each reported year by the U.S. Census estimates of the number of children aged 1–2 years during each year that jurisdictions submitted data to CBLs. Every effort was made to count children with multiple tests only once.

State and local childhood lead surveillance systems are passive surveillance systems that rely on BLL test results reported by private and public laboratories. Reporting criteria are set by each state and vary across jurisdictions, although by 2002, a total of 29 states mandated reporting of all BLLs (16). Test results are compiled and put through quality assurance measures by state health departments. The results are submitted quarterly to CDC and entered into CBLs. Because of missing information, demographic data, including race/ethnicity, Medicaid status, and housing status were not used for this analysis.

This report provides CBLs data for children aged 1–2 years who were tested for BLLs at least once during January 1, 2002–December 31, 2010. The following are surveillance definitions for all states:

- **Test:** Any blood lead drawn (capillary, venous, or unknown sample type) on a child that produces a quantifiable result and is analyzed by a Clinical Laboratory Improvement Amendments (CLIA)–certified facility or an approved portable device. A blood lead test may be collected for screening, confirmation, or follow-up.
- **Confirmed BLL $\geq 10 \mu\text{g}/\text{dL}$:** A child with one venous blood specimen $\geq 10 \mu\text{g}/\text{dL}$, or two capillary blood specimens $\geq 10 \mu\text{g}/\text{dL}$ drawn within 12 weeks of each other (2,3).
- **Unconfirmed BLL $\geq 10 \mu\text{g}/\text{dL}$:** A single capillary blood lead test $\geq 10 \mu\text{g}/\text{dL}$, or two capillary tests $\geq 10 \mu\text{g}/\text{dL}$ with >12 weeks apart.
- **BLL 5–9 $\mu\text{g}/\text{dL}$:** A single blood lead test (capillary or venous) with a result of 5–9 $\mu\text{g}/\text{dL}$.

To estimate the national prevalence of BLLs $\geq 5 \mu\text{g}/\text{dL}$ and $\geq 10 \mu\text{g}/\text{dL}$ among children aged 1–2 years, CDC used data from NHANES, a cross-sectional, nationally representative survey of the noninstitutionalized U.S. population. Since 1999, NHANES has been conducted as an ongoing survey, with data reported in 2-year cycles. NHANES survey and analytic methods have been described previously (17). The analyses provided in this report are made on the basis of NHANES data on children aged 1–2 years who were tested. Through the NHANES analyses, CDC has defined a BLL $\geq 5 \mu\text{g}/\text{dL}$ as high. The percentage of children living in older housing with BLLs $\geq 5 \mu\text{g}/\text{dL}$ as well as demographic characteristics and 95% confidence intervals also were calculated. Statistically significant differences in demographic characteristics and housing were evaluated using pairwise t-tests, and differences were considered statistically significant at $p < 0.05$. This report includes the available data from 1999–2010. To assess the

prevalence of BLLs ≥ 5 $\mu\text{g}/\text{dL}$ over time among children aged 1–2 years living in housing built before 1950, housing built during 1950–1977, and housing built after 1977, CDC analyzed data from the six most recent NHANES cycles (1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008 and 2009–2010). For some of the NHANES analyses, the estimates are not reliable (i.e., relative standard error is ≥ 30) but are the best that are available for the U.S. population, and the sample sizes are small across variables only for the age group 1–2 years.

Prevalence rates in the NHANES data with BLLs ≥ 5 $\mu\text{g}/\text{dL}$ were analyzed by sex, race/ethnicity, poverty-to-income ratio, Medicaid status, and age of housing. Statistical analyses were performed using SAS version 9.2 (18) and SUDAAN 10.0.1 (19), a software package that incorporates the sample weights and adjusts the analyses for the complex sample design of NHANES. All analyses used examination sample weights to account for the unequal probability of election, oversampling, and survey nonresponse.

Results

In 2002, CBLS received reported BLLs from 43 states and DC; BLL tests were reported for approximately 22% of children aged 1–2 years (Table 1). By 2010, the BLL screening rate for this age group had increased to 33.4%. The number of children aged 1–2 years screened for BLLs reported to CDC ranged from 1,617,667 (982,005 children aged 1 year and 635,662 children aged 2 years) in 2002 to a high for the study period of 2,557,445 (1,506,620 children aged 1 year and 1,050,825 in children aged 2 years) in 2009. In 2010, a total of 2.0% of children aged 1–2 years tested had confirmed BLLs ≥ 10 $\mu\text{g}/\text{dL}$ compared with 9.3% in 2002. The percentage of children aged 1–2 years tested with BLLs 5–9 $\mu\text{g}/\text{dL}$ also decreased from 14.9% in 2002 to 4.2% in 2010.

NHANES data from 2007–2010 indicate that 3.1% of children aged 1–2 years had BLLs ≥ 5 $\mu\text{g}/\text{dL}$. Among non-Hispanic black children aged 1–2 years, 7.7% had BLLs ≥ 5 $\mu\text{g}/\text{dL}$ compared with 1.6% of Mexican-American children aged 1–2 years (95% CI = 0.7–3.0). Differences for the prevalence of BLLs ≥ 5 $\mu\text{g}/\text{dL}$ were observed by poverty levels; 6.0% of children living in a household with a poverty-to-income ratio of < 1.3 had BLLs ≥ 5 $\mu\text{g}/\text{dL}$, compared with 0.5% of children living in a household with a poverty-to-income ratio of ≥ 1.3 had BLLs ≥ 5 $\mu\text{g}/\text{dL}$. These findings indicate the same disparity in risk by factors that have been important historically (Table 2).

The NHANES estimate of the percentage of children aged 1–2 years living in pre-1950 housing remained steady from 1999 to 2010 (Table 3). The greatest decline in the percentage of children having BLLs ≥ 5 $\mu\text{g}/\text{dL}$ from 1999 to 2010 occurred among children living in pre-1950 housing (25.9% versus 3.7%, respectively; $p < 0.05$) (Table 3). However, children living in pre-1950 housing were 10 and four times more likely to have BLLs ≥ 5 $\mu\text{g}/\text{dL}$ compared with children living in homes built after 1978 during the NHANES 1999–2002 and 2007–2010 cycles, respectively (Table 3).

Discussion

During 2002–2010, lead screening rates in children aged 1–2 years increased from 21.5% in 2002 to 33.4% in 2010. Because of the limitation of the demographic data in CBLS and the lack of a single national definition of children at risk, the screening rate of children at risk cannot be established. In 2008, a total of 24,546 children aged 1–2 years had confirmed BLLs ≥ 10 $\mu\text{g}/\text{dL}$, compared with 19,915 children with such levels in 2010. Taken together, CBLS and NHANES data indicate that the *Healthy People 2010* objective of eliminating BLLs ≥ 10 $\mu\text{g}/\text{dL}$ has not been

TABLE 1. Number of reporting U.S. states and the District of Columbia submitting child blood lead surveillance data to CDC and the number of children aged 1–2 years tested, screening rates, confirmed blood lead levels (BLLs) ≥ 10 $\mu\text{g}/\text{dL}$, and blood lead levels 5–9 $\mu\text{g}/\text{dL}$, by year — Child Blood Lead Surveillance System, United States, 2002–2010

Year	No. of states and DC submitting data to CDC	No. of children tested			Estimated screening rate of children aged 1–2 yrs		Children aged 1–2 yrs with confirmed BLLs ≥ 10 $\mu\text{g}/\text{dL}$		Children aged 1–2 yrs with BLLs 5–9 $\mu\text{g}/\text{dL}$	
		Age < 6 yrs	Age 1 yr	Age 2 yrs	No.*	(%)	No.	(%)	No.	(%)
2002	44	2,652,964	982,005	635,662	7,517,329	(21.5)	58,990	(9.3)	394,960	(14.9)
2003	44	3,092,229	1,164,543	754,432	7,585,463	(25.3)	63,239	(8.4)	408,989	(13.2)
2004	42	3,250,848	1,256,114	813,710	7,541,388	(27.4)	55,540	(6.8)	377,453	(11.6)
2005	38	3,529,634	1,331,544	874,600	7,493,713	(29.4)	50,627	(5.8)	328,735	(9.3)
2006	39	4,168,544	1,437,734	936,532	7,701,311	(30.8)	46,115	(4.9)	315,514	(7.6)
2007	38	3,977,282	1,349,950	970,424	7,599,552	(30.5)	33,544	(3.5)	280,628	(7.1)
2008	36	4,296,559	1,491,743	998,412	7,646,874	(32.6)	24,546	(2.5)	228,455	(5.3)
2009	36	4,365,446	1,506,620	1,050,825	7,700,266	(33.2)	23,053	(2.2)	206,111	(4.7)
2010	35	4,003,420	1,378,633	985,581	7,071,322	(33.4)	19,915	(2.0)	167,792	(4.2)

Abbreviations: BLLs = blood lead levels; DC = District of Columbia.

* The denominator is the U.S. Census Bureau's projected estimates for the number of children aged 1–2 years for the states that submitted lead data to CDC. (Source: US Census Bureau. Estimates of children aged 1–2 years. Washington, DC: US Census Bureau; 2012. Available at <http://www.census.gov/popest>.)

TABLE 2. Number and percentage of children aged 1–2 years with blood lead levels $\geq 5 \mu\text{g}/\text{dL}$, by selected demographic characteristics — National Health and Nutrition Examination Survey, United States, 2007–2010

Characteristic	No.	%	(95% CI)
Sex			
Male	410	3.1	(1.6–5.0)
Female	383	3.2	(1.8–4.9)
Race/ethnicity			
Black, non-Hispanic	164	7.7	(4.0–12.4)
Mexican-American	238	1.6	(0.7–3.0)*
White, non-Hispanic	252	3.2	(1.2–6.0)*
Poverty-to-income ratio[†]			
<1.3	430	6.0	(3.7–8.9)
≥ 1.3	309	0.5	(0.1–1.2)*
Medicaid status			
Yes	326	5.3	(3.2–7.8)
No	467	2.1	(1.1–3.4)
Total	793	3.1	(2.1–4.4)

Abbreviation: CI = confidence interval.

* Relative standard error ≥ 30 .

[†] Income-to-poverty ratios represent the ratio of family or unrelated individual income to their appropriate poverty threshold. (Source: US Census Bureau. Current population survey [CPS] – definitions. Washington, DC: US Census Bureau; 2014. Available at <http://www.census.gov/cps/about/cpsdef.html>.)

TABLE 3. Percentage of children aged 1–2 years with blood lead levels $\geq 5 \mu\text{g}/\text{dL}$, predicted by age of housing — National Health and Nutrition Examination Survey, United States, 1999–2010

Housing	%	(95% CI)	%	(95% CI)	%	(95% CI)
After 1978	2.5	(0.7–5.4)*	2.7	(1.1–5.1)*	1.0	(0.2–2.4)*
1950–1977	8.9	(5.0–13.9)	3.0	(1.1–5.7)*	1.1	(0.1–3.0)*
Before 1950 [†]	25.9	(16.3–36.9)	12.5	(6.1–20.8)	3.7	(1.6–6.7)*
Refused to say or did not know	17.7	(12.0–24.5)	8.2	(4.5–12.8)	7.5	(4.6–11.1)

Abbreviation: CI = confidence interval.

* Relative standard error ≥ 30 .

[†] The percentage of children living in any housing built before 1950 was 13.7% for 1999–2002, 13.9% for 2003–2006, and 13.9% for 2007–2010.

achieved. An analysis conducted by the Centers for Medicare and Medicaid Services indicated that approximately 66% of children enrolled in Medicaid were screened for lead during 2008–2009 despite the requirement that all children enrolled in Medicaid receive a blood lead test at ages 12 and 24 months (20).

The reduction in disparities by housing and demographic factors might indicate success in screening and interventions for the children at highest risk. However, the persistence of these disparities also underscores the need to continue efforts to ensure identification of children with BLLs at or above the reference range value.

According to the U.S. Preventive Services Task Force (USPSTF), blood lead screening for children is a Grade I recommendation, which means that the evidence is insufficient to recommend for or against routine screening for elevated blood lead levels in asymptomatic children aged 1–5 years who are at increased risk (21). Nonetheless, as this report indicates, children who are on

Medicaid, living in poverty, and living in older housing are more likely than other children to have BLLs $\geq 5 \mu\text{g}/\text{dL}$. For this reason, the screening rate for these children needs to be improved. Because the majority of children with BLLs $\geq 5 \mu\text{g}/\text{dL}$ are asymptomatic, children who are at risk for lead exposure need to be tested to determine if their exposure is high. Subsequently, lead hazards in their environments need to be addressed to reduce permanent neurologic disorders directly resulting from BLLs $\geq 5 \mu\text{g}/\text{dL}$. The key stakeholders for improving lead screening include CDC, state and local health departments, and primary care providers. It is essential that state and local health departments improve their communications to primary care providers in the areas and populations of children within their state and locality at high risk for lead exposure. CDC concurred with ACCLPP's recommendation for education and follow-up testing for children with BLLs $\geq 5 \mu\text{g}/\text{dL}$; this is accomplished typically through a letter from the health department to the primary care provider, but more opportunities exist to improve screening children at high risk, such as Geographic Information Systems mapping to show providers the high-risk areas (22). Primary care providers can use and disseminate this information from state and local health agencies. Increasing primary care providers' knowledge of lead exposure will make it more likely that they will screen children at high risk in their area. Also, it is important that all parents receive education on how to prevent lead exposure in the home and that children at high risk be screened for lead.

Previous cost effectiveness studies of lead screening indicate that universal screening is the most cost-effective strategy in high-prevalence populations (23). In the late 1990s, the cost per confirmed BLL $\geq 10 \mu\text{g}/\text{dL}$ in a high-prevalence neighborhood population was \$490. The cost of a blood lead test ranges from \$10 to \$75 (23). As a result of the 2012 change in reference value to $5 \mu\text{g}/\text{dL}$, studies are needed to evaluate the cost-effectiveness of screening children for lead at this level. In addition, further research would support opportunities to evaluate what strategies would be effective in further increasing screening rates in young children.

An estimated \$43 billion in annual costs for medical care and potential productivity losses of affected children when they become adults are attributed to lead as an environmental pollutant (24). Since 1991, federal and state agencies have adopted requirements for lead-safe work practices and developed a trained and visible workforce that can safely eliminate lead paint hazards in housing, implemented stricter standards for lead in products marketed to children and reduced lead concentrations in water (25). State and local health and housing programs have used local data to identify geographic areas and subpopulations at high risk for BLLs $\geq 5 \mu\text{g}/\text{dL}$ and $\geq 10 \mu\text{g}/\text{dL}$, as well as specific properties on which many children have been exposed to the same lead hazards over time. Each state has used

its data to determine where the high-risk areas lie and developed targeted screening plans. For example, Ohio has mapped confirmed BLLs ≥ 10 $\mu\text{g}/\text{dL}$ by county to show providers high-risk areas (26). These data should be used to continue to direct lead paint hazard control resources, identify new sources of lead exposure (e.g., traditional pottery or medicines in newly arrived populations), and anticipate increased lead exposure resulting from environmental changes (e.g., alterations in water chemistry that might increase lead solubility in water). CDC's Lead Poisoning Prevention Program will continue to research better ways to target screening children at high risk in the United States and to analyze trends in lead exposure in children through data from state and local health departments across the United States. The U.S. Department of Housing and Urban Development could use CDC's prevalence data to provide strategies to identify those areas to which healthy housing funds should be distributed (i.e., the areas at highest risk). Efforts are needed for nonprofit organizations to continue to promote programs and policies that are in line with the screening guidelines and for health and housing departments to pursue efforts to increase screening among children living in high-risk housing.

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (27). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (28); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (29); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines (30) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (31); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (32). The Bright Futures guidelines recommend lead screening for children at multiple points as a child ages on the basis of the risk for lead exposure (10). State Medicaid programs cover lead screening as part of the Early and Periodic Screening, Diagnostic and Treatment benefit.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect

as early as January 2014.[†] Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level (FPL) who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including lead screening.

Limitations

The findings in this report are subject to at least three limitations. First, approximately 4.3 million children are tested in 34 states and the District of Columbia, each jurisdiction collating its own data and conducting its own quality assurance measures. The information about the child and the blood lead test often is transferred from the clinical laboratory through various channels to the health-care provider and ultimately to the state health department. To assign one test per year to a child, state-based programs must match multiple tests for a child or risk having duplicate records per child in their systems. Second, CBLS does not collect children's names or street address information, requiring state health departments to de-duplicate child records using data available at the state level. As a result, children might not be matched correctly, and the data could be missing confirmed BLLs. Finally, blood lead estimates from CBLS and NHANES should be used to complement one another; the data should not be compared because each system has distinct methodologies and different data collection protocols. The state surveillance systems provide data at state and local levels that can be used to target screening efforts and primary prevention practices to children at high risk. However, because not all children at high risk are tested, CBLS does not provide a complete accounting of all children at high risk in a given jurisdiction. A study conducted in 2001 indicated that 61% of the children tested in a high-risk neighborhood had never had a blood lead test (33). Thus population prevalence values cannot be calculated by using CBLS data.

NHANES data represent a national representative sample, and estimates generated from the data are generalizable to the U.S. population as a whole. In addition, since NHANES was not designed to produce estimates at the state and local level, it might overlook statistically significant disparities that have important public health implications at state and local levels. NHANES also has a high proportion of missing data for age

[†]The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

of housing. NHANES and state surveillance data also differ in methods of blood lead test samples. For NHANES, all blood lead tests are collected by venous sampling, the most accurate method and analyzed using inductively coupled plasma mass spectrometry at a single laboratory at CDC (17).

Blood lead tests reported to state and local health departments can be either a venous or a repeat capillary sample. Capillary samples are not as accurate as venous samples and are easily contaminated if proper procedures are not followed (34). However, capillary BLLs have been demonstrated to provide adequate estimates at the population level (34). CDC recommends that children with capillary tests with BLLs $\geq 10 \mu\text{g}/\text{dL}$ be retested with a venous sample or capillary sample within 12 weeks. However, this is not always possible, and thus CBLS might underestimate or overestimate the number of children with BLLs $\geq 10 \mu\text{g}/\text{dL}$ because children are lost to follow up before providing a confirmatory sample (35).

Conclusion

Screening and early identification of children at risk for lead exposure has the potential to prevent permanent neurologic damage and behavioral disorders in hundreds of thousands of young children across the United States. Increasing the number of children with regular access to primary care, environmental assessment, and lead hazard control could substantially reduce the number of young children in the United States with BLLs $\geq 5 \mu\text{g}/\text{dL}$. CDC will continue to work closely with state and local health departments to find ways to increase blood lead screening for children at risk. These data have important uses beyond identification of children in need of services as they can be used to identify subpopulations and geographic areas where primary prevention activities can be used and reduce or eliminate lead sources before children are exposed.

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Vision Screening Among Children Aged <6 Years — Medical Expenditure Panel Survey, United States, 2009-2010

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Introduction

Amblyopia or lazy eye is an important cause of monocular blindness (1–3) and is associated with a 2.6 fold increase in the risk for bilateral visual impairment in adults (4). However, amblyopia can usually be prevented through early detection and treatment. Treatment focuses on correcting the underlying cause of amblyopia (e.g., strabismus or unequal refractive error) and promoting the use of the amblyogenic eye (e.g., through patching of the other eye). Effectiveness of treatment decreases with age and is less successful after age 12 years (5,6). The overall prevalence of amblyopia among children aged 6 months to 6 years is 1% to 2%. In addition, the prevalence of amblyogenic risk factors among children in this age range is approximately 3% (7,8). Because amblyopia can usually be prevented with early intervention, preschool vision screening for the prevention of amblyopia is considered cost-effective (9).

Many children with or at risk for amblyopia have no symptoms. Therefore, the U.S. Preventive Services Task Force (USPSTF) recommends vision screening for all children at least once between ages 3 and 5 years to detect the presence of amblyopia or its risk factors. This is a USPSTF Grade B recommendation, which means USPSTF recommends the service. There is moderate certainty that vision screening for children aged 3–5 years has a moderate net benefit (10). As described in the USPSTF statement (10), many different vision screening tests are available, including those that evaluate vision directly (e.g., visual acuity or stereoacuity tests), automated and semiautomated devices that evaluate refraction and ocular alignment (e.g., autorefractors and photoscreeners), and tests that rely on physical examinations (e.g., cover-uncover test and the Hirschberg light reflex test). Although USPSTF does not recommend a specific test, the American Academy of Pediatrics (AAP) and other professional societies recommend either tests of visual acuity and stereoacuity or the use of an autorefractor or photoscreener (11). USPSTF did not find

sufficient evidence to make a recommendation regarding vision screening for those aged <3 years.

The public health importance of vision loss prevention from amblyopia is underscored by the *Healthy People 2020* objective of increasing from 40.1% to 44.1% the proportion of children aged ≤5 years and who receive vision screening (on the basis of data from the National Health Interview Survey, objective V-1 (12). A previous study using 2006–2007 Medical Expenditure Panel Survey (MEPS) data found that 64.9% of parents reported that their children aged 3–6 years ever had vision screening attempted (13). This proportion exceeds that used to set the *Healthy People 2020* objective because it excluded children aged <3 years, for which no standard national recommendation exists for vision screening.

To highlight the importance of vision screening, the National Quality Forum (NQF) had established a specific quality measure (NQF #1412): the percentage of preschool-aged children who receive vision screening in the medical home (14). Preschool vision screening also is a component of the Early and Periodic Screening, Diagnostic and Treatment (EPSDT) benefit provided to those enrolled in Medicaid (15). The Bright Futures recommendations for preventive pediatric care, supported by the Health Resources and Services Administration (HRSA), include annual vision screening for children aged 3–6 years (16). To supplement the preschool vision screening services offered within primary care settings, screening is often provided in group settings (e.g., within preschools) by advocacy groups or by state public health departments.

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians, and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in

this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (17). This report analyzes 2009–2010 data from MEPS to determine the proportion of children who have received vision screening before age 6 years. Public health agencies can use these data to benchmark progress toward the goal of improving vision screening in this age group and reducing the prevalence of amblyopia.

Methods

To estimate the proportion of children who had received vision screening before age 6 years, CDC analyzed 2009–2010 data from the MEPS Child Preventive Health section of the Household component. MEPS is a set of nationally representative surveys of health and health-care delivery in the United States, and provides nationally representative estimates on health-care use, expenditures, sources of payment, and insurance coverage for the U.S. civilian noninstitutionalized population. Participants are selected from the previous year's National Health Interview Survey. The methods and sample source material are described in detail elsewhere (18).

The unit of analysis was the child. The study population consisted of children aged 60–71 months (i.e., aged 5 years) at the time of the survey. Receipt of vision screening was classified on the basis of response to the question: "Has a doctor or other health provider ever checked (PERSON)'s vision?" A person was considered to have received vision screening if the response was "Yes" or "Tried but (PERSON) was uncooperative." Attempts at vision screening were included because children might have been uncooperative because they had difficulty seeing. Children who are persistently noncooperative should be referred for a comprehensive eye examination. No information is provided in MEPS regarding the type of screening, where it was conducted, when it was conducted, who performed the screening, or the outcome of screening.

The relation between reported screening and several variables was evaluated; variables included sex, race/ethnicity, family income, insurance status at the time of the vision screening question, and whether the child had a special health-care need. Race/ethnicity was classified as non-Hispanic white, non-Hispanic black, Hispanic, and other. Family income was classified as <200% of the federal poverty level or ≥200% of the federal poverty level. Insurance coverage was classified as none (uninsured for entire year), any private (private coverage at any time during the year), and public only. Children with special health care needs were classified in MEPS using a standardized screener completed by parents. The basis for the

screener is having a known limitation in activity, or either using or requiring more health-care services than other children.

CDC used statistical software for all analyses. All results, including means, proportions, and 95% confidence intervals (95% CIs), were adjusted for sampling design and by poststratification weights to reflect population level estimates. Chi-squared tests were used for bivariate comparisons of the categorical variables. Statistical significance was defined as $p < 0.05$.

Results

A total of 1,141 children aged 5 years were included in the 2009–2010 MEPS. Overall, 77.9% of these children were reported as having ever had their vision checked by a doctor or other health-care provider. Of those who were reported to have had their vision checked, only four were reported to have been unsuccessful attempts.

The characteristics of subjects were stratified by age and the bivariate associations analyzed between the characteristics and proportion of children reported to have ever been vision screened (Table). Hispanic children were less likely than non-Hispanic children to have reported vision screening. Children whose families earned ≥200% above the federal poverty level were more likely to have reported vision screening than those whose families had lower incomes. Those with no insurance

TABLE. Percentage of children aged 5 years that have ever had their vision screened, by select characteristics — Medical Expenditure Panel Survey, United States, 2009–2010

Population/Characteristic	%	Proportion screened	
		%	(95% CI)
Sex			
Boys	49.4	76.3	(71.6%–80.5%)
Girls	50.6	79.5	(74.9%–83.4%)
Race/ethnicity[†]			
White, non-Hispanic	52.9	80.7	(75.3%–85.2%)
Black, non-Hispanic	12.7	80.7	(74.7%–85.6%)
Hispanic	24.9	69.8	(64.0%–74.9%)
Other	9.5	80.0	(67.7%–88.3%)
Family income			
<200% of FPL	44.6	69.0	(63.3%–74.1%)
≥200% of FPL	55.4	85.1	(80.6%–88.7%)
Insurance			
None	3.1	39.3	(24.3%–56.6%)
Public only	37.3	73.4	(68.3%–78.0%)
Any private	59.6	82.6	(77.9%–86.5%)
Special health-care need			
No	81.7	77.2	(73.2%–80.8%)
Yes	18.3	81.5	(73.4%–87.6%)
Total		77.9	(74.3–81.2)

Abbreviation: CI = confidence interval; FPL = federal poverty level.

* Categorical differences are statistically significant for race/ethnicity, income, and insurance (Chi-squared tests, $p < 0.001$).

[†] Persons of Hispanic ethnicity might be of any race or combination of races.

were less likely than those with public only or any private insurance to have reported screening. No statistically significant difference existed by sex or the presence of a special health-care need.

Discussion

By age 6 years, approximately 78% of children were estimated to have had their vision checked by a doctor or other health-care provider. This finding is substantially higher than the rate reported (40.1% of preschool children aged ≤ 5 that reported receiving vision screening in 2008) in *Healthy People 2020* (objective V-1) because of a difference in the approach to analysis. In this evaluation, the focus was on the lifetime screening before age 6 years. However, this rate is still suboptimal; missed vision screening can contribute to preventable blindness in adults. In addition, differences were identified in screening rates by race/ethnicity, family income, and insurance status, which could lead to disparities in vision status.

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (19). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (20); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (21); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP (22) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (23); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (24). USPSTF recommends vision screening as a Grade B service for all children at least once between ages 3 and 5 years (10). The Bright Futures guidelines recommend vision screening for children at multiple points as the child ages (16). State Medicaid programs cover vision screening as part of EPSDT.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect

as early as January 2014.* Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including vision screening.

MEPS is the only nationally representative survey that conducts ongoing surveillance to monitor vision screening rates in children. However, the vision screening question, “Has a doctor or other health provider ever checked (PERSON)’s vision?” does not assess the type of provider or location of the screening and does not focus on tests that could identify amblyopia. The question reflects any previous vision check that can occur from birth to the time of participation in MEPS, and respondents can vary in what they consider to qualify as checked vision, which could range from simple assessment of the red reflex to use of formal screening tests, including visual acuity assessment, tests of stereopsis, or autorefractometry. Furthermore, no data are available regarding the results of the vision screening or the degree to which any necessary follow-up eye examinations or treatment occurred.

To address these gaps in surveillance and to improve the delivery of preschool vision services, HRSA's Maternal and Child Health Bureau funds a cooperative agreement with Prevent Blindness America to establish the National Center for Children's Vision and Eye Health (25). The Center is designed to support the public health role in ensuring a continuum of eye care for young children within the health-care delivery system and in the medical home (25). The activities of the Center are coordinated by Prevent Blindness America, a nonprofit organization, in partnership with CDC's National Center for Health Statistics, CDC's Vision Health Initiative, the Office of Head Start, the National Eye Institute, and Indian Health Service. These activities are guided by an expert panel that includes primary care providers, ophthalmologists, and optometrists. The Center is currently engaged in establishing evidence-based guidelines for vision screening and follow-up and in the development of state-based data systems for the monitoring and reporting of vision screening, follow-up eye care, and vision outcomes (25). In addition, the current National Survey of Children's Health, also supported by HRSA, in partnership with the National Center for Health Statistics, includes items that will provide more specific information on the age at vision screening, the type of test performed, and the location of the vision screening (26).

*The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

Limitations

The findings in this report are subject to at least five limitations. First, no information is provided about the timing (i.e., precise age of child at the time of screening). Second, no information exists regarding the quality of the screening (i.e., who performed the screen or the protocol employed). Third, no record exists of the outcome of the screening. Fourth, recall bias might affect the estimates. Finally, parents might not understand what is meant by screening (simple assessment to comprehensive eye examination), and therefore might believe other services (e.g., diagnostic care and treatment) are included. Each limitation has the potential to overestimate or underestimate the results of this analysis, and therefore, the results should be interpreted with caution.

Conclusion

Preschool vision screening is critical to improving long-term vision outcomes. Unfortunately, many children do not receive timely vision screening. Public health activities, including work by the National Center for Children's Vision and Eye Health to improve surveillance and the delivery of vision screening within primary care settings, and state and local efforts to provide screening within the community, are central to decreasing the long-term morbidity associated with amblyopia.

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Hypertension Screening in Children and Adolescents — National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, and Medical Expenditure Panel Survey, United States, 2007–2010

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Introduction

Hypertension and prehypertension have been increasing among children and adolescents since the 1990s (1,2). During 2003–2006, among children and adolescents aged 8–17 years, the prevalence of prehypertension was approximately 14% in boys and approximately 6% in girls, and the prevalence of hypertension was estimated to be 3%–4% in various studies (1,3,4). During 1997–2006, hospitalization rates for children and adolescents with a diagnosis of hypertension doubled, from approximately 18 cases per 100,000 pediatric hospital discharges in 1997 to approximately 35 cases per 100,000 in 2006 (5). Among children and adolescents with hypertension, as many as one in three has target organ damage, especially left ventricular hypertrophy (4,6). Accumulating evidence supports the theory that elevated blood pressure levels in adolescence are a precursor of elevated blood pressure in adulthood, making it important to identify elevated blood pressure in childhood (7). An analysis of the National Childhood Blood Pressure database found that 14% of adolescents with prehypertension developed elevated blood pressure within 2 years (8).

A *Healthy People 2020* objective (objective HDS-5.2) is to reduce the prevalence of hypertension among children and adolescents by 10% (3). In 2004, the National High Blood Pressure Education Program (NHBPEP) Working Group on Children and Adolescents recommended that health-care providers measure blood pressure in children aged >3 years who are seen in a medical setting (9). The Bright Futures guidelines developed by the American Academy of Pediatrics (AAP) at the request of the Health Resources and Services Administration (HRSA) recommends that children and adolescents aged 3–17 years receive blood pressure screening during their annual preventive care visit (10,11). However, in 2006, only 85% of children and adolescents had a preventive

health-care visit (12). The National Quality Forum (NQF) has endorsed blood pressure screening as a performance measure, with documentation in the medical record as to whether the result is abnormal for children during the year they reach age 13 years and again during the year they reach age 18 years (NQF #1552 and NQF #1553) (13).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (14). This report analyzes 2007–2010 data from the National Ambulatory Medical Care Survey (NAMCS), the National Hospital Ambulatory Medical Care Survey (NHAMCS), and the Medical Expenditure Panel Survey (MEPS) to estimate the prevalence of blood pressure measurement at visits among children and adolescents aged 3–17 years. These estimates can serve as a baseline to track the progress and impact of preventive blood pressure screening for children and adolescents. Public health plays an important role in working with the health care sector and other stakeholders to increase the use of this screening. Public health officials and clinicians can use these data to identify population groups that might benefit from additional strategies to access and receive recommended blood pressure screening in children and adolescents.

Methods

NAMCS/NHAMCS

To estimate the prevalence of blood pressure measurement by providers at visits among children and adolescents aged 3–17 years, CDC analyzed 2007–2010 data from NAMCS and NHAMCS (15). These two national surveys collect data annually on the provision of ambulatory care services to patients of all ages from office-based physicians and hospital outpatient departments. The methods and sampling frame of NAMCS and NHAMCS have been described in detail elsewhere (16). Only preventive care visits were included in this analysis, defined by answering “yes” to the question of whether this was a preventive care visit or by using the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) clinical diagnoses of V20, V70.0, V70.3, V70.6, V70.8, or V70.9. In addition, only visits to pediatricians or general practice providers were included. Visits by persons with diagnoses of hypertension (defined by an ICD-9-CM clinical diagnosis of 401–405 or by checkbox those who had hypertension) were excluded.

The unit of analysis used was a patient visit. With the exception of physician and clinic specialty (obtained from the provider/facility induction interview and sampling frames), all data for this analysis were obtained through abstraction of patient visit records using a standardized patient record form. Key items included on the patient record form include major reason for visit (preventive care), a maximum of three ICD-9-CM diagnosis codes related to the visit, and systolic blood pressure. The presence or absence of a recorded systolic blood pressure was used as an indicator of blood pressure measurement. Univariate t-tests were used to examine differences in the prevalence of blood pressure measurement over time and also between subgroups within the combined 2009–2010 survey cycles.

A total of 2,963 patient visits (weighted estimate 53,748,445) met the inclusion criteria for 2007–2008, and 2,941 patient visits (weighted estimate 61,631,434) met the inclusion criteria for 2009–2010. Data from NAMCS and NHAMCS were combined, and two time intervals were selected for analysis: 2007–2008 and 2009–2010. Patient visit weights were used to extrapolate these findings to national estimates. A two-tailed t-test with a p-value of <0.05 was deemed statistically significant.

MEPS

To estimate the number of household respondents who recalled having the child’s blood pressure measured among children and adolescents aged 3–17 years, CDC analyzed 2007–2010 data from MEPS Child Preventive Health section of the Household

component. MEPS collects data from a sample of families and persons across the United States drawn from a nationally representative subsample of households that participated in the prior year’s National Health Interview Survey (conducted by CDC’s National Center for Health Statistics). The methods and sampling frame are described in detail elsewhere (17).

The unit of analysis was the child or adolescent. The study population comprised children and adolescents aged 3–17 years who were not institutionalized at any time during the study period and for whom complete data on blood pressure measurement and covariates of interest were available. The sample was limited to those children and adolescents who had made at least one nonemergency office or clinic visit during the year before the survey; 17% (n = 5,935) of the sample was excluded because no such clinic or office visit was reported. The designated household respondent answered questions about the child’s health. Blood pressure measurement was determined by assessing whether the child or adolescent had ever had their blood pressure measured and, if it had been measured, how long ago it had been measured. Respondents had five options to answer how long ago blood pressure had been measured: “within the past year,” “within the past 2 years,” “more than 2 years ago,” “don’t know,” or “refused.” Only those respondents who were able to answer definitively “yes” or “no” when asked whether the child or adolescent’s blood pressure had been measured in the past year were included in the analysis. Additional covariates included type of health insurance at the time of interview, whether the participant had a usual place to go for health care, the type of place usual health care was sought (i.e. “office,” “hospital non-ER,” or “hospital ER”), and poverty level, defined as family income as a percentage of the federal poverty level (FPL). Five categories were used for analysis: “poor,” defined as <100% of FPL; “near poor,” defined as 100%–124% of FPL; “low income,” defined as 125%–199% of FPL; “middle income,” defined as 200%–399% of FPL; and “high income,” defined as ≥400% of FPL. For all questions, response options of “refused” and “don’t know” were provided to minimize reporting bias in the survey. Univariate t-tests were used to examine differences in the prevalence of blood pressure measurement over time and also between subgroups within the combined 2009–2010 survey cycles. Statistically unstable results were suppressed (relative standard error >30%).

Data from MEPS were combined, and two periods were selected for analysis: 2007–2008 and 2009–2010. Participant weights were used to extrapolate these findings to national estimates. After those for whom blood pressure measurement data were missing (n = 1,502) and covariates of interest (n = 273) were excluded, 10,475 participants aged 3–17 years had made at least one nonemergency health-care visit in the previous year for 2007–2008, and 11,143 met this inclusion

criteria for 2009–2010. A two-tailed t-test with a p-value of <0.05 was deemed statistically significant.

Results

NAMCS/NHAMCS

During 2007–2008 and 2009–2010, blood pressure measurement was documented for children and adolescents at 73.7% and 75.7% of preventive care clinic visits, respectively ($p = 0.5$) (Table 1). Blood pressure was recorded more often for visits by adolescents aged 11–17 years (81.9%) compared with children aged 3–10 years (71.6%; $p < 0.01$). No difference was detected in blood pressure being recorded at visits by males or females. Preventive care visits by non-Hispanic whites had the highest rates of blood pressure recording (78.2%) compared with visits by members of other racial/ethnic groups, but rates were not

significantly different. Preventive care visits by private pay patients had higher rates of blood pressure recording (79.6%) compared with visits by Medicaid or State Children's Health Insurance Program (SCHIP/CHIP) patients (69.1%; $p < 0.01$). There was no difference in blood pressure recording at preventive care visits by pediatricians and general practice providers ($p = 0.15$).

MEPS

During 2009–2010, over two thirds of respondents recalled blood pressure being measured at a nonemergency care physician or clinic visit (69.6%) among children and adolescents who had one or more nonemergency care physician or clinic visits during the previous year, compared with 66.0% in 2007–2008 ($p = 0.001$) (Table 2). In 2009–2010, blood pressure measurement was recalled more often for adolescents aged 11–17 years (80.2%) compared with children aged 3–10

TABLE 1. Number and percentage of preventive care visits with blood pressure recorded among children and adolescents aged 3–17 years — National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey, United States, 2007–2010

Characteristic	2007–2008				2009–2010				Trend p value [†]	Subgroup p value [§]
	Sample		BP measurement		Sample		BP measurement			
	No.	(%) [*]	%	(SE)	No.	(%) [*]	%	(SE)		
Age group (yrs)										
3–10	1,777	(60.6)	70.0	(2.7)	1,721	60.1	71.6	(2.8)	0.681	
11–17	1,186	(39.4)	79.4	(2.7)	1,220	39.9	81.9	(2.1)	0.454	<0.001
Sex										
Male	1,486	(50.8)	73.5	(2.4)	1,530	54.4	76.2	(2.5)	0.400	
Female	1,477	(49.2)	74.0	(2.8)	1,411	45.6	75.0	(2.6)	0.751	0.673
Race/Ethnicity										
White, non-Hispanic	1,234	(56.5)	76.7	(2.1)	1,281	58.8	78.2	(2.3)	0.590	
Black, non-Hispanic	785	(15.7)	72.6	(4.4)	699	15.3	74.0	(3.1)	0.793	0.240
Hispanic [¶]	682	(20.4)	69.9	(4.0)	721	19.4	72.1	(3.3)	0.673	0.055
Other	262	(7.3)	63.6	(10.4)	240	6.5	67.3	(6.2)	0.758	0.050
Region**										
Northeast	939	(20.7)	76.4	(5.5)	961	23.4	76.1	(5.0)	0.955	
Midwest	832	(25.3)	80.3	(2.6)	713	20.4	78.2	(3.6)	0.596	0.733
South	617	(30.8)	70.2	(4.3)	664	33.0	76.7	(3.7)	0.223	0.929
West	575	(23.2)	68.8	(5.0)	603	23.2	71.8	(4.3)	0.643	0.516
Source of payment^{††}										
Private	1,058	(62.7)	76.4	(2.6)	1,154	64.4	79.6	(2.7)	0.356	
Medicaid or SCHIP	1,536	(30.9)	68.0	(3.8)	1,394	30.0	69.1	(3.2)	0.799	0.009
Other	231	(6.4)	70.7	(6.8)	256	5.6	73.4	(7.1)	0.792	0.417
Provider specialty										
Pediatrics	2,172	(75.7)	73.0	(2.9)	2,202	79.8	74.4	(2.6)	0.702	
General practice	791	(24.3)	75.9	(2.9)	739	20.2	80.9	(3.4)	0.255	0.147
Total	2,963		73.7	(2.3)	2,941		75.7	(2.1)	0.498	

Abbreviations: BP = blood pressure; SCHIP = State Children's Health Insurance Program; SE = standard error.

^{*} Percentages are weighted.

[†] Unadjusted t-test for difference in prevalence of BP measurement between 2007–2008 and 2009–2010.

[§] Unadjusted t-test for difference in prevalence of BP measurement between subgroups during 2009–2010.

[¶] Persons of Hispanic ethnicity can be of any race or combination of races.

^{**} *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia, and *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^{††} Information on type of payments was missing for 138 visits during 2007–2008 and for 137 visits during 2009–2010.

years (62.2%; $p < 0.01$). No difference was detected in recall of blood pressure measurement between males and females ($p = 0.16$), and recall of blood pressure being measured did not differ by race/ethnicity ($p > 0.05$). Children and adolescents

from families that were defined as near poor and low-income were less likely to report blood pressure screening than families defined as high income ($p < 0.05$). Respondents living in the Northeast were more likely than those living in other regions of

TABLE 2. Percentage of blood pressure measurement recalled by household respondents for children and adolescents aged 3–17 years who had at least one nonemergency care visit to a physician or clinic in the year before the survey — Medical Expenditure Panel Survey, United States, 2007–2010

Characteristic	2007–2008				2009–2010				Trend p value*	Subgroup p value†
	Sample		BP measurement		Sample		BP measurement			
	No.	(%)	%	(SE)	No.	(%)	%	(SE)		
Age group (yrs)										
3–10	6,248	58.0	58.9	(1.0)	6,648	(58.6)	62.2	(1.2)	0.018	
11–17	4,227	42.0	75.9	(1.0)	4,495	(41.4)	80.2	(0.8)	0.001	<0.001
Sex										
Male	5,336	50.7	66.4	(1.0)	5,674	(50.8)	68.8	(1.1)	0.083	
Female	5,139	49.3	65.6	(1.1)	5,469	(49.2)	70.5	(1.0)	0.000	0.157
Race/Ethnicity										
White, non-Hispanic	4,041	59.1	66.5	(1.2)	3,929	(57.0)	69.7	(1.2)	0.034	
Black, non-Hispanic	2,154	14.2	66.3	(1.6)	2,365	(13.6)	69.2	(1.4)	0.151	0.772
Hispanic [§]	3,419	19.2	66.1	(1.3)	3,779	(21.1)	70.1	(1.7)	0.037	0.832
Other	861	7.5	61.5	(2.5)	1,070	(8.2)	68.6	(1.9)	0.010	0.598
Income										
Poor (<100% FPL)	2,887	17.2	64.0	(1.5)	3,284	(19.0)	68.6	(1.6)	0.203	0.066
Near poor (100%–124% FPL)	776	4.9	62.8	(2.9)	841	(5.1)	65.5	(2.8)	0.480	0.017
Low income (125%–199% FPL)	1,935	14.4	64.7	(1.8)	1,974	(15.2)	65.7	(1.6)	0.657	0.001
Middle income (200%–399% FPL)	2,831	33.1	65.9	(1.5)	3,045	(31.6)	70.0	(1.4)	0.035	0.165
High income (≥400% FPL)	2,046	30.4	68.5	(1.5)	1,999	(29.1)	72.7	(1.5)	0.038	
Census Region[¶]										
Northeast	1,766	19.6	75.6	(1.8)	1,702	(18.7)	78.0	(1.9)	0.238	
Midwest	2,172	22.8	65.3	(1.7)	2,395	(21.8)	71.1	(1.6)	0.005	0.005
South	3,747	35.1	63.4	(1.4)	4,012	(36.5)	66.7	(1.6)	0.115	<0.001
West	2,790	22.5	62.5	(1.9)	3,034	(23.0)	66.1	(1.4)	0.081	<0.001
Type of insurance^{**}										
Private	4,807	60.1	66.5	(1.1)	4,874	(57.9)	69.8	(1.1)	0.031	0.018
Public	4,529	30.0	65.4	(1.2)	5,247	(33.7)	70.9	(1.3)	0.001	0.004
None	1,139	9.9	65.0	(2.1)	1,022	(8.4)	63.5	(2.4)	0.619	
Usual source of care^{††}										
Yes	9,662	92.9	67.0	(0.9)	10,276	(93.3)	70.7	(0.9)	0.001	
No	813	7.1	53.4	(2.4)	867	(6.7)	55.6	(2.4)	0.492	<0.001
Type of place for usual care^{§§}										
Office	7,856	79.1	66.6	(0.9)	8,181	(78.5)	70.1	(0.9)	0.003	
Hospital non-ER	1,778	13.7	69.4	(1.8)	2,072	(14.7)	73.5	(1.7)	0.075	0.058
Hospital ER	28	0.2	— ^{¶¶}		23	(0.2)	—		0.576	
None	813	7.1	53.4	(2.4)	867	(6.7)	55.6	(2.4)	0.492	<0.001
Total^{***}	10,475		66.0	(0.8)	11,143		69.6	(0.9)	0.001	

Abbreviations: BP = blood pressure; ER = emergency room; FPL = federal poverty level; SE = standard error.

* Unadjusted t-test for difference in prevalence of BP measurement between 2007–2008 and 2009–2010.

† Unadjusted t-test for difference in prevalence of BP measurement between subgroups during 2009–2010.

§ Persons of Hispanic ethnicity can be of any race or combination of races.

¶ *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia, and *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

** Type of insurance reported at the time of interview. Private insurance includes any private insurance, regardless of possible public insurance supplements.

†† Response to question, "Is there a particular doctor's office, clinic, health center, or other place that (PERSON) usually (go/goes) if (PERSON) (are/is) sick or (need/needs) advice about (PERSON)'s health?" "Yes" includes an answer of "Yes" or "There is more than one place."

§§ Answer to question, "Is (PROVIDER)/Does (PROVIDER) work at] a clinic in a hospital, a hospital outpatient department, an emergency department at a hospital, or some other kind of place?"

¶¶ Statistically unstable estimates suppressed (relative standard error >30%).

*** Among those who had one or more office or clinic visit(s) in the previous year: an answer of >0 to the question, "In the last 12 months, not counting times (PERSON) went to an emergency room, how many times did (PERSON) go to a doctor's office or clinic to get health care?" OR the total number of office-based visits (Health Care Utilization) >0.

the country to recall blood pressure being measured ($p < 0.01$). Respondents with private or public insurance were more likely to recall blood pressure being measured than those without insurance ($p = 0.02$ and < 0.01 respectively). Seven percent of respondents said that the child did not have a usual source of care; these respondents were less likely to recall blood pressure being measured (55.6%) than those with a usual source (70.7%; $p < 0.01$). Recall of blood pressure measurement did not differ by usual care location ($p > 0.05$).

Discussion

The data provided in this report indicate the frequency of blood pressure screening at ambulatory care visits by children and adolescents, not the prevalence of hypertension. This might be the first report to compare the rate of household respondents' recall of whether blood pressure was measured in the year before the survey with provider responses as to whether blood pressure was recorded at preventive care visits for children and adolescents aged 3–17 years. During 2009–2010, responses from providers in NAMCS/NHAMCS and responses from household respondents in MEPS showed similar screening rates; providers reported measuring blood pressure at approximately 76% of visits, and household respondents recalled receipt of blood pressure measurement at approximately 70% of visits. A nonsignificant increase was noted in blood pressure being recorded at preventive care visits in 2009–2010 compared with 2007–2008 in NAMCS/NHAMCS, which is consistent with the increase in blood pressure measurement recall in MEPS for the same years. The nonsignificant difference in blood pressure screening among non-Hispanic whites and members of racial/ethnic groups other than non-Hispanic blacks and Hispanics might be attributable to the small sample size of other groups in both surveys. On the basis of this analysis, blood pressure screening rates among children and adolescents have increased from previous reports that used NAMCS/NHAMCS data for 2000–2001 (51%) (18) and MEPS data for 2004–2006 (66%) (19) and 2006–2007 (66%) (20). However, the NAMCS/NHAMCS data suggest that blood pressure measurement at preventive care visits among children and adolescents is slightly higher than that recalled by household respondents in MEPS.

Overall rates of blood pressure measurement at ambulatory care visits by children and adolescents continue to increase; however, the data provided in this report indicate that the most disadvantaged children and adolescents in terms of receipt of blood pressure measurement at preventive care visits are those using Medicaid or SCHIP/CHIP in the provider data and those $< 125\%$ of FPL or living in the West in the household

respondents' recall data. Younger children (aged 3–10 years) had a lower frequency of blood pressure measurement at care visits in the provider data as well as among household respondents' recall.

Although the U.S. Preventive Services Task Force (USPSTF) found insufficient evidence in 2002 to recommend for or against routine screening for high blood pressure in children and adolescents because of a lack of evidence on the benefits and harms of screening (21), the USPSTF assessment was made before the 2004 recommendations from NHBPEP. In 2004, the National Heart, Lung, and Blood Institute convened the NHBPEP Working Group on children and adolescents to provide guidance on definitions and diagnosis of high blood pressure in children and adolescents, on the basis of data from the National Health and Nutrition Examination Survey. In addition to recommending screening starting at age 3 years, the NHBPEP Working Group recommended that children and adolescents with prehypertension and hypertension be considered candidates for lifestyle interventions (i.e., weight reduction, increased physical activity, and adoption of healthy eating habits) to reduce blood pressure, with pharmacologic approaches reserved for children and adolescents with elevated blood pressure that does not respond to lifestyle interventions or for those who have secondary causes of hypertension (9). An updated review conducted by USPSTF in 2012 concluded that blood pressure screening in children and adolescents might be effective in identifying high blood pressure, but insufficient evidence exists on routine screening, and false positive rates might be high. Following the 2012 USPSTF review, the previous recommendation was not changed (22); however, reducing high blood pressure among children aged 8–17 years by 10% (from 3.5% to 3.2%) is a *Healthy People 2020* objective (HDS-5.2) (3).

Public health authorities and other stakeholders should work with health-care providers to increase blood pressure screening in children and adolescents. Few programs exist outside of provider educational efforts to improve blood pressure screening in children and adolescents. Medicare and Medicaid provide financial incentives to improve blood pressure screening in children and adolescents through Stages 1 and 2 of Meaningful Use* (for health information technology), in which providers are required to record blood pressure in the electronic medical record in patients aged ≥ 3 years (23). Health-care providers can use well-child visits and physical examinations for sports participation as opportunities to increase screening rates among children (22). Information in

*To achieve meaningful use, eligible providers and hospitals must adopt certified electronic health record technology and use it to achieve specific objectives. These objectives and measures, known as Meaningful Use, are to occur over 5 years (2011–2016). Stage 1 is focused on data capture and sharing and stage 2 on advancing clinical processes. Details are provided at <http://www.healthit.gov/policy-researchers-implementers/meaningful-use-regulations>.

the literature on the cost-effectiveness of blood pressure screening in children and adolescents as recommended in the guidelines is scant. A recent modeling study on the cost-effectiveness of blood pressure screening in adolescents found that at the individual level, mass blood pressure screening followed by treatment for those with secondary hypertension was modestly cost-effective. Population-wide approaches of increasing physical activity classes and salt reduction campaigns have been demonstrated to be potentially more effective and more cost-effective than routine blood pressure screening and treatment for high blood pressure prevention and control among adolescents; however, routine screening is potentially more effective and less costly than selective screening or no screening (24). Another study demonstrated that the use of ambulatory blood pressure monitoring among children and adolescents with suspected hypertension was highly cost-effective because of the high prevalence of white coat hypertension in the pediatric population (25).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (26). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (27); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (28); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP (11) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (29); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (30). The Bright Futures guidelines recommend blood pressure screening at multiple points as the child ages (11). State Medicaid programs cover hypertension screening as part of the Early and Periodic Screening, Diagnostic and Treatment benefit.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.[†] Federal tax credits are available on a sliding scale

to assist those living at 100%–400% of FPL who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including hypertension screening (ACA § 1001). Health insurance coverage reforms under ACA could result in greater numbers of children and adolescents receiving blood pressure screening.

Limitations

The findings in this report are subject to at least five limitations. First, NAMCS and NHAMCS data were selected for preventive care visits only. Visits other than an annual care visit might have been included in the definition of a preventive care visit. This bias could lead to an under- or overestimation of blood pressure screening at preventive care visits. Second, blood pressure could have been taken at the preventive care visit but not recorded on the patient record form for NAMCS and NHAMCS. This bias could lead to an underestimation of blood pressure screening. Third, NAMCS and NHAMCS data are representative of patient visits rather than individual patients. Therefore, children who visit their doctors most frequently (e.g., those who are sicker) potentially could be represented more than once in the sample, although this would be unlikely because the analysis included only preventive care visits. In addition, services such as blood pressure measurement not provided at a given sampled visit might have been provided to the patient at another visit. Fourth, MEPS relies on a single household respondent's recall and is subject to recall bias. Finally, for recall of blood pressure measurement in MEPS, the household respondent might not have been present or might have been unable to witness whether the blood pressure was taken. This bias could lead to an underestimation of blood pressure screening from the MEPS survey. Although these two surveys are considered to be nationally representative, they did not survey an identical population. Therefore, caution should be used in comparing the results from the two surveys.

Conclusion

This study provides new information that household respondents' reports of blood pressure measurement in the year before the survey for children and adolescents are similar to provider reports of blood pressure measurement at preventive care visits (70% and 76% respectively) during the year of the survey. In addition, children and adolescents using Medicaid or those <200% of FPL appear to receive blood pressure screening less often than those with private insurance or those with higher income. Further studies are needed to confirm

[†] The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

and/or track these findings of disparities in blood pressure screening among children and adolescents. Opportunities exist to address the *Healthy People 2020* objective for reducing high blood pressure among children and adolescents by improving blood pressure screening at preventive care visits while at the same time addressing healthy lifestyle behaviors for children and adolescents.

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Use of Dental Care and Effective Preventive Services in Preventing Tooth Decay Among U.S. Children and Adolescents — Medical Expenditure Panel Survey, United States, 2003–2009 and National Health and Nutrition Examination Survey, United States, 2005–2010

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Introduction

Tooth decay is one of the most common chronic conditions among children. Approximately 23% of children aged 2–11 years have at least one primary tooth with untreated decay and 20% of adolescents aged 12–19 years have at least one permanent tooth with untreated decay (1). Tooth decay, if left untreated, can cause pain and infection, and can lead to problems with eating, speaking, and learning (2). Risk factors for tooth decay include recent history of cavities, low fluoride exposure, and living in a low-income household (3). Prevalence of untreated decay in primary or permanent teeth among children from lower-income households is more than twice that among children from higher-income households (1). Prevalence of untreated tooth decay is also higher among Mexican-American children and non-Hispanic black children than among white non-Hispanic children (1). By age 15, approximately 60% of all adolescents will have experienced tooth decay (1). An estimated 51.7 million school hours are missed annually by school-aged children because of a dental problem or visit (4).

In 2009, the total dental expenses for U.S. children aged 5–17 years were approximately \$20 billion (5), accounting for 17.7% of all health-care expenses among this age group (6). Approximately 40% of dental costs were paid out of pocket (5), compared with 17% for medical care (6). Approximately one fourth of U.S. children do not have dental insurance (private or public) (7). The types of services covered by dental insurance vary widely by plan, but typically have higher copayments and lower annual limits than services covered by medical insurance (8).

Clinical interventions, including dental sealants and fluoride (e.g., topical gels and varnishes and oral fluoride supplementation) are effective in preventing and controlling

tooth decay. Dental sealants are coatings placed on the pits and fissures of posterior teeth where the majority of decay occurs in children (9). A systematic review of randomized controlled trials found that dental sealants reduce decay in permanent molars by 81% approximately 2 years after placement and continue to be effective up to 4.5 years after placement (10). Effectiveness remains strong as long as sealants are retained in the pits and fissures (3). For these reasons, combined with findings that sealant retention rates exceed 70% in the primary teeth after 3 years, the American Dental Association (ADA) Council on Scientific Affairs recommends the placement of dental sealants on primary and permanent molars for children at risk for developing tooth decay (9). Although the recommendation was made on the basis of clinical effectiveness, the ADA Council on Scientific Affairs noted that several economic models demonstrated that delivering sealants to children at-risk for caries also was cost-effective. Two models found that placing sealants on the permanent first molars of children at high-risk for tooth decay strictly dominated not placing sealants (i.e., reduced cavities and saved costs) (11,12). Systematic reviews of randomized controlled trials also have found that professional or professionally supervised application of fluoride gel prevents more than one quarter of decay in permanent teeth (13) and professional application of fluoride varnish prevents one third of decay in primary teeth and almost half of decay in permanent teeth (14). The ADA Council on Scientific Affairs also recommends for at-risk children aged <6 years the professional application of 2.26 percent fluoride varnish at least twice yearly and for at-risk children aged ≥6 years, the professional application of 2.26 percent fluoride varnish or 1.23 percent (APF*) fluoride gel

* Acidulated Phosphate Fluoride.

at least twice yearly (15). In addition, the U.S. Preventive Services Task Force (USPSTF) recommends that primary care clinicians apply fluoride varnish to the primary teeth of all infants and young children beginning when their first primary tooth comes in (USPSTF Grade B recommendation, which means USPSTF recommends the service) (16); and that they prescribe oral fluoride supplementation at currently recommended doses to preschool children beginning at age 6 months whose primary water source is deficient in fluoride (USPSTF Grade B recommendation) (16).

Preventing tooth decay is enhanced by early identification of children at high risk for the disease (3) and subsequent delivery of effective interventions. The American Academy of Pediatrics (AAP) (17), ADA, the Academy of General Dentistry, and the American Academy of Pediatric Dentistry (AAPD) encourage families to have accessed a dental home by the time their child is 1 year old to deter the development of tooth decay (18)[†]. AAPD recommends that after the first dental visit a child should be seen by a dentist every 6 months or, according to a schedule recommended by the dentist, on the basis of the child's individual needs (19). The National Quality Forum (NQF) has endorsed two oral health performance measures related to dental use. These include the percentage of children and adolescents enrolled in Medicaid with an annual dental visit (NQF #1388) and the percentage of children and adolescents with a preventive dental visit in the past 12 months (NQF #1334) (20).

Although preventive dental care is effective, for reasons previously noted, the percentage of children using dental care is low (1). The *Healthy People 2020* initiative, recognizing the problem of low use of preventive dental care, especially among those at highest risk, set several oral health objectives (OH) to increase acceptance and adoption of effective preventive interventions (21). These objectives include 1) increasing the proportion of children, adolescents, and adults who used the oral health care system in the past year from its baseline value of 44.5% by 10% (objective OH-7, a leading health indicator); 2) increasing the proportion of low-income children and adolescents who received any preventive dental service during the past year from its baseline value of 30.2% by 10% (objective OH-8); and 3) increasing the proportion of children and adolescents who have received dental sealants on their molar teeth by 10% (objective OH-12).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of

selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (22). This report analyzes 2003–2009 data from the Medical Expenditure Panel Survey (MEPS) and 2005–2010 data from the National Health and Nutrition Examination Survey (NHANES) to determine the proportion of children and adolescents who have used dental care and received preventive dental services. Public health agencies play an important role in increasing access to preventive dental services by supporting provision of preventive services in nonclinical settings such as schools. These agencies also can promote policies that increase access to preventive dental services such as increasing Medicaid reimbursements for dental services and increasing public awareness about the importance of oral health and the effectiveness of the use of fluorides and sealants. Public health agencies can use these data to benchmark progress toward the goal of improving regular access to dental care and to preventive services and reducing the prevalence of tooth decay in children and adolescents.

Methods

To estimate the use of dental care and receipt of preventive dental services, specifically professionally applied sealant or topical fluoride gel or varnish within the calendar year, CDC analyzed 2009 data from MEPS[§] for 12,143 children and adolescents aged 0–21 years. To evaluate trends, CDC used MEPS data during 2003–2009. MEPS is a set of large-scale surveys of families and persons, their medical providers, and employers across the United States. Dental data are collected during the survey of families and persons who are drawn from a nationally representative subsample of households that participated in the previous year's National Health Interview Survey (conducted by the National Center for Health Statistics). The receipt of dental services measures for 2009 are presented by the following characteristics: child's sex, age, race/ethnicity, health insurance status, dental insurance status (e.g., reported having private dental insurance at some point within the past year), and disability status; family income-poverty ratio; and head of household education level.

To estimate the prevalence of sealant use for children and adolescents aged 5–19 years, CDC analyzed combined 2005–2010 NHANES data (three cycles). NHANES is a complex, multistage probability sample of the noninstitutionalized U.S. population.[¶] During 2005–2010, an examiner visually assessed

[†]Dental care is provided in a comprehensive, continuously accessible, coordinated, and family centered way.

[§]Additional information is available at <http://meps.ahrq.gov/mepsweb/>.

[¶]Additional information is available at <http://www.cdc.gov/nchs/nhanes.htm>.

each child's teeth using the Basic Screening Examination (BSE) and recorded information including whether the child had at least one tooth with a sealant. During 2005–2010, a total of 8,492 children and adolescents aged 5–19 years received a BSE; of these, 8,481 had valid data for dental sealants. NHANES did not collect data for sealants on children aged <5 years during 2005–2008, nor adolescents aged >19 years during 2009–2010. Sealants remain on teeth for several years after placement (9), and do not need to be replaced every year. For this reason, expected estimates of the percentage of children who have sealants on their teeth at the time of NHANES examination will be higher than estimates of the percentage of children who received sealants in 1 year from the MEPS survey.

Dental insurance status was not available from NHANES during 2005–2010. Otherwise, estimates of sealant prevalence are presented by the same characteristics as the receipt of dental service measures from MEPS. For MEPS estimates, disability was defined as receiving help or supervision in conducting activities of daily living because of impairment, or a physical or mental health problem. For NHANES estimates, disability was defined as reporting a limitation in crawling, walking, running, or playing, having a long-term impairment or health problem, or having received special education or early intervention.

All analyses were conducted using statistical software to account for the complex sample design of MEPS and NHANES data. Estimates from MEPS and NHANES were obtained using the expenditure file person weights and the examination sample weights, respectively. Estimates with relative standard errors >30% are not presented. Confidence intervals (CIs) reported are 95% CIs. To test whether use of dental care, receipt of preventive dental services, or prevalence of dental sealants varied by the characteristic of the child, CDC used a chi-square test of independence for nominal characteristic variables and a chi-square test of linear trend for ordinal characteristic variables. Cochran-Mantel-Haenszel Chi-square tests of linear trend were used to test whether receipt of dental services varied from 2003 to 2009. All findings reported in the text are determined to be significant at $p < 0.05$.

Results

Less than half of children aged ≤21 years (43.8%) used dental care in 2009 and only 14.2% of children aged ≤21 years received a preventive dental service (i.e., topical fluoride, sealants, or both) (Table 1). Children aged 6–10 years and 11–15 years were more likely to use dental care (55.0% and 57.8%, respectively) than children aged 0–2 years (7.6%), 3–5 years (43.7%), and 16–21 years (41.8%). Lower likelihood of dental care use and receipt of preventive care was associated

with being a non-Hispanic black or Hispanic child, having lower family income, head of household having lower educational attainment, and not having medical insurance. Children with private dental insurance were more likely to receive preventive care than were children without private dental insurance.

The percentage of children and adolescents using dental care or receiving a preventive dental service annually did not vary during 2003–2009 (Figure). Among children who used

TABLE 1. Prevalence of dental visit and receipt of preventive services (topical fluoride, sealant, or both) among children and adolescents, aged 0–21 years — Medical Expenditure Panel Survey, United States, 2009

Characteristic	Dental visit			Preventive services	
	No.	%	(95% CI)	%	(95% CI)
Sex					
Male	6,240	42.5*	(40.4–44.5)	14.3	(12.8–15.9)
Female	5,903	45.1	(43.0–47.2)	14.2	(12.7–15.8)
Age group (years)					
0–10	6,128	38.7*	(36.7–40.7)	15.9*	(14.4–17.6)
0–2	1,599	7.6	(6.0–9.7)	1.7	(1.1–2.5)
3–5	1,768	43.7	(40.2–47.1)	17.5	(15.0–20.3)
6–10	2,761	55.0	(52.3–57.6)	23.9	(21.5–26.6)
11–21	6,015	48.8*	(46.6–51.2)	12.5*	(11.1–14.1)
11–15	2,807	57.8	(54.8–60.8)	20.8	(18.4–23.4)
16–21	3,208	41.8	(39.1–44.7)	6.2	(5.0–7.7)
Race/Ethnicity[†]					
Hispanic	3,102	34.7*	(32.3–37.1)	9.8*	(8.1–11.7)
Black, non-Hispanic	2,690	33.6	(30.8–36.5)	9.8	(7.8–12.3)
White, non-Hispanic	3,968	50.0	(47.3–52.8)	16.7	(14.9–18.8)
Other	2,383	38.9	(35.9–42.4)	13.5	(11.3–16.1)
Family income-poverty ratio					
<100	3,837	32.6 [§]	(29.8–35.4)	8.9 [§]	(7.3–10.9)
100–199	3,150	33.9	(31.2–36.6)	10.7	(9.0–12.6)
200–499	3,888	48.7	(46.4–51.1)	16.3	(14.4–18.3)
≥500	1,268	57.2	(52.8–61.4)	20.0	(16.5–24.0)
Education, head of household					
Less than high school	2,159	31.7 [§]	(28.3–35.2)	7.0 [§]	(5.2–9.3)
High school or equivalent	5,363	38.2	(36.1–40.4)	12.2	(10.8–13.9)
Some college	993	48.1	(43.5–52.8)	15.0	(11.8–18.9)
College graduate	2,922	55.3	(52.1–58.4)	19.8	(17.1–22.8)
Health Insurance					
Any private	5,604	51.4*	(49.1–53.7)	17.4*	(15.6–19.4)
Medicaid/Children's Health Insurance Program	5,274	36.1	(33.4–38.9)	11.0	(9.5–12.8)
Other public	48	45.4	(25.3–67.1)	— [¶]	
Uninsured	1,217	18.6	(15.3–22.5)	3.9	(2.5–6.1)
Private dental insurance					
Yes	4,277	52.1*	(49.5–54.8)	18.4*	(16.1–20.9)
No	7,866	36.5	(34.8–39.0)	10.8	(9.5–12.4)
Disabilities					
Yes	237	42.8	(34.6–50.7)	12.1	(6.9–20.4)
No	11,906	43.8	(42.0–45.6)	14.3	(12.9–15.7)
Total	12,143	43.8	(42.0–45.6)	14.2	(12.9–15.6)

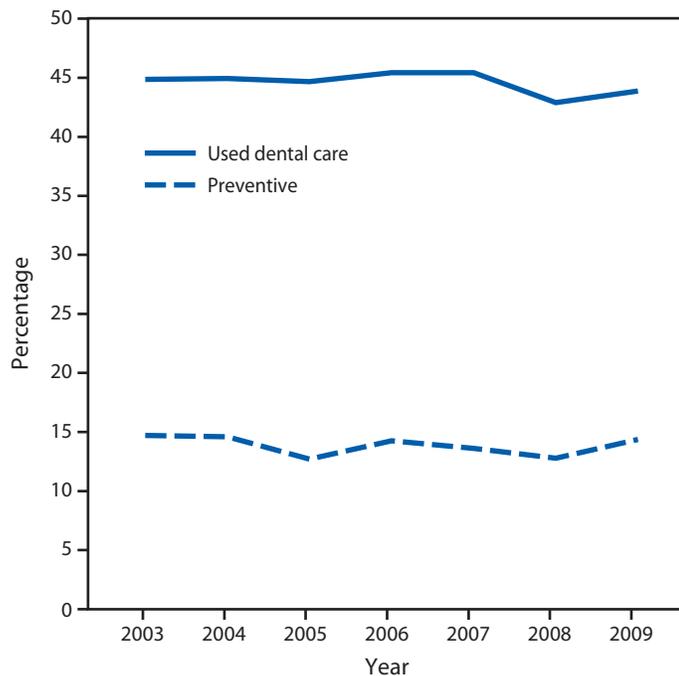
* Chi-square test of independence significant at $p < 0.05$.

[†] Persons of Hispanic ethnicity might be of any race or combination of races.

[§] Chi-square test of linear trend significant at $p < 0.05$.

[¶] Relative standard error >30%.

FIGURE. Percentage of children and adolescents aged 0–21 years who used dental care or received preventive dental services (topical fluoride, or sealant, or both) in a calendar year — Medical Expenditure Panel Survey, United States, 2003–2009



dental care, approximately one third received topical fluoride or a sealant. However, among children who used dental care, those with private health insurance or from families with higher income or education were more likely to receive these preventive services.

Approximately 31% of children aged 5–19 years had at least one dental sealant during 2005–2010 (Table 2). Lower sealant prevalence was associated with being non-Hispanic black or Mexican American, having lower family income, head of household having lower educational attainment, or not having private health insurance. Neither dental sealant prevalence nor dental use varied by disability status.

Discussion

In 2009, less than half of children and adolescents had a dental visit in the past year, and approximately 15% of children received sealants or topical fluoride. These low levels of dental use have persisted throughout the preceding decade. Sealant prevalence was also low; among children with teeth likely to be eligible for sealant placement, less than one third had sealants.

Socioeconomic groups with low levels of dental use—non-Hispanic blacks, Hispanics, those with low family income, and low educational attainment by head of household—also have been documented to have higher prevalence of untreated

TABLE 2. Prevalence of dental sealants among children and adolescents aged 5–19 years — Medical Expenditure Panel Survey, United States, 2009, and National Health and Nutrition Examination Survey, United States, 2005–2010

Characteristic	No.	%	(95% CI)
Sex			
Male	4,326	29.8*	(27.5–32.2)
Female	4,155	32.9	(30.3–35.5)
Age group (yrs)			
5–19	8,481	31.3*	(29.3–33.3)
5–10	3,451	24.3	(22.2–26.4)
11–19	5,030	35.8	(33.4–38.3)
11–15	2,825	39.4	(36.4–42.5)
16–19	2,205	31.1	(27.9–34.5)
Race/Ethnicity			
Mexican-American	2,470	26.7*	(24.1–29.5)
Black, non-Hispanic	2,284	21.0	(18.4–23.9)
White, non-Hispanic	2,527	34.4	(31.4–37.5)
Other	1,200	33.3	(29.8–37.0)
Family income-poverty ratio			
<100	2,487	24.2†	(21.4–27.2)
100–199	2,165	25.8	(22.7–29.3)
200–499	2,464	35.0	(32.2–38.0)
≥500	815	38.5	(33.8–43.5)
Education of head of household			
Less than high school	2,208	24.2†	(21.0–27.7)
High school graduate or equivalent	1,781	26.7	(23.6–30.1)
Some college	2,503	29.8	(27.1–32.6)
College graduate	1,789	39.5	(36.6–42.4)
Health insurance			
Private or military	3,938	35.0*	(33.0–37.1)
Medicaid/ Children's Health Insurance Program	2,049	25.2	(21.7–29.1)
Not insured	2,364	21.8	(18.2–25.9)
Disability			
Yes	1,009	29.1	(26.2–32.1)
No	7,471	31.6	(29.5–33.7)
Total	8,481	31.3	(29.3–33.3)

* Chi-square test of independence significant at $p < 0.05$.

† Chi-square test of linear trend significant at $p < 0.05$.

decay than the general population (1). The low use of dental care and preventive dental services among children at high-risk for dental problems is likely associated with financial barriers and low oral health literacy. The findings in this report indicate that children with private dental insurance were more likely to have had a dental visit during the past year and to have received preventive dental services than were children without private dental insurance. A recent Institute of Medicine (IOM) report found that low oral health literacy in the United States created obstacles to recognizing the risk for oral diseases as well as seeking and receiving needed oral health care (8).

This report also found that very young children (aged <3 years) were even less likely than older children to use dental care. Among these very young children at risk for tooth decay, early establishment of a dental home might reduce dental treatment costs. An analysis of North Carolina Medicaid claims data during

1992–1997 found that children who received a preventive dental service before age 1 year had lower dental costs over 5 years than did children receiving their first preventive service at age 2–5 years (23). However, a later analysis of North Carolina Medicaid claims during 1999–2006 found no difference in subsequent dental decay related treatment outcomes between children receiving their first preventive dental visit by age 18 months compared with children at age 18–42 months. Children with existing dental decay receiving their first tertiary preventive visit before age 18 months did have lower rates of subsequent treatment and dental treatment costs than similar children aged 18–42 months (24).

This report only included sealants and topical fluoride as preventive services on the basis of their strong evidence of effectiveness (10,13,14). Dental prophylaxis (e.g., tooth cleaning and polishing), a commonly received service, was not included because insufficient evidence exists that it prevents tooth decay (25). As a result, the percentage of children receiving preventive dental services in this report is lower than values reported in other studies (7,26).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (27). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (28); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (29); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by the Health Resources and Services Administration (HRSA) and AAP (18) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (30); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (31). USPSTF recommends application of fluoride varnish to the primary teeth of preschool children beginning when the first tooth comes in as a Grade B service and oral fluoride supplementation as a Grade B service for preschool children beginning at age 6 months and whose primary water source is deficient in fluoride (16). Bright Futures guidelines recommend certain oral health services for children and adolescents including pediatric oral health risk assessments beginning at age 6 months (18). State Medicaid programs cover

oral health services as part of the Early and Periodic Screening, Diagnostic and Treatment benefit.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.[§] Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing. These services delivered by primary care providers include oral fluoride supplementation for preschool children beginning at age 6 months whose primary water source is deficient in fluoride, fluoride varnish for children aged <6 years, and certain oral health services for children (e.g., pediatric oral health risk assessments) beginning at age 6 months. The Affordable Care Act also includes provisions addressing the supply of dental providers. Specifically, the Act authorizes the Secretary of the U.S. Department of Health and Human Services to make grants to fund the training of general, pediatric, and public-health dentists, and establish a loan repayment program for dental faculty in institutions (ACA § 5303). The U.S. Department of Health and Human Services also has developed a multiagency national action plan to improve health literacy, of which oral health was a component (32). One of the plan's goals is to promote changes in the health-care delivery system that improve health information, communication, informed decision-making, and access to health services.

The receipt of preventive dental services should increase over time because of the provisions in the Affordable Care Act that address oral health, including the insurance reforms that require that certain oral health services be covered and the training grants designed to increase the supply of dental health providers. A recent IOM report emphasized the importance of the U.S. Department of Health and Human Services promoting the use of preventive dental services because of the strong evidence for their effectiveness, which could potentially reduce overall treatment need and costs (33). Increased dental insurance coverage and other measures should increase the likelihood that very young children have a dental home.

Public health agencies and organizations, dental providers and their professional societies, and private and public insurers are key stakeholders in increasing receipt of preventive dental services. Public health surveillance can identify population subgroups that might require additional strategies to access

[§]The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

clinical services needed to prevent dental decay. Recently, CDC's Division of Oral Health, the Association of State and Territorial Dental Directors, and the Council of State and Territorial Epidemiologists, added indicators of Medicaid and Children's Health Insurance Program (CHIP) beneficiaries' use of clinical dental preventive services to the National Oral Health Surveillance System (34).

Dental providers and insurers play a key role in ensuring that children receive timely and effective dental care. ADA, the Centers for Medicare and Medicaid Services (CMS), private insurers, and federal public health agencies participate in the Dental Quality Alliance, which was formed to develop and test quality measures for oral health. The Association of State and Territorial Dental Directors and the Medicaid/CHIP State Dental Association also recently formed the Partnership for Alignment Project to assess and facilitate collaboration between state public health and medical assistance departments. Collaboration might include increased use of Medicaid/CHIP enrollment and claims data for public health program planning, and use of public health strategies to increase access to care for Medicaid/CHIP enrolled children through the CMS-sponsored voluntary state pediatric oral health action plan.

CDC's Division of Oral Health, through cooperative agreements with state grantees, funds school-based sealant programs (SBSP) and state infrastructure to increase effectiveness, reach, and efficiency of these programs. SBSP typically target schools with students likely to have high levels of untreated decay and low use of clinical services (i.e., where >50% of children are eligible for the reduced and free meal program) and provide children with referrals for clinical dental care. Strong evidence supports the effectiveness of SBSP in preventing decay (10) and increasing the number of high risk children (e.g., Medicaid enrolled) who receive sealants (35). Evidence also demonstrates that sealants are cost-effective when provided to children from low-income families. An analysis of Alabama Medicaid claims data during 1985–1992 found that total dental costs (including the cost of sealants) were lower among children receiving sealants (36). An analysis of North Carolina Medicaid claims data found that among high-risk children (i.e., who had received caries related procedures on at least two chewing surfaces), providing sealants was associated with lower dental costs over a 5-year period (37). Finally, an analysis of total dental costs among children from low-income families found that average total dental costs were lower for children who participated in a school-based sealant program than children who attended a school without such a program (38).

Limitations

The findings in this report are subject to at least two limitations. First, MEPS data used to generate measures of use are self-reported or reported by parents and caregivers. Although MEPS collects information from medical providers and insurers, in addition to that from patients, on use of medical services, it does not do so for dental care. Because MEPS interviews patients several times (i.e., approximately every 6 months over 2 years), it might be less subject to recall and social desirability bias than self-reported dental care use in other national surveys, which asks respondents once about the time since they last received dental care (39). Second, the dental data collection protocol for NHANES changed between 2005–2008 and 2009–2010. The type of examiner changed from health technicians in 2005–2008 to dental hygienists in 2009–2010. However, in all cycles of NHANES during 2005–2010 examiners were trained by the U.S. standard reference examiner, and interexaminer reliability for presence of dental sealants ranged from substantial to almost perfect (40).

Conclusion

Dental decay is one of the most common health conditions among children and adolescents. Although clinical interventions are effective in preventing and controlling tooth decay, only 44% of children and adolescents visited a dentist in 2009, and 14% received a dental sealant or topical fluoride application. These low levels of use persisted during 2003–2009. During 2005–2010, less than one third of children had a dental sealant. Provisions in the Affordable Care Act likely will increase the number of children and adolescents with regular access to dental care and to preventive services that have the potential to substantially reduce tooth decay. This might ultimately lead to improved quality of life and school performance.

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National Human Papillomavirus Vaccination Coverage Among Adolescents Aged 13–17 Years — National Immunization Survey – Teen, United States, 2011

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Introduction

Genital human papillomavirus (HPV) is the most common sexually transmitted infection in the United States. An estimated 14 million persons are newly infected with HPV each year; approximately half of new HPV infections occur among persons aged 15–24 years (1). Although the majority of HPV infections are asymptomatic and resolve, persistent infections can cause disease, including cancers. No cure exists for HPV infection; treatments can be directed only at HPV-associated lesions (e.g., warts, precancerous lesions, and cancers) (2). Annual costs of cervical cancer screening and treatment of HPV-associated health outcomes have been estimated at \$8 billion (in 2010 U.S. dollars) (3). Almost all cervical cancers and many vaginal, vulvar, anal, penile, and oropharyngeal cancers are attributable to persistent, oncogenic HPV infections (4). In 2009, approximately 35,000 HPV-associated cancers were reported in the United States. Of these, 39% occurred in males (4).

Approximately 100 HPV types have been described; HPV types 16 and 18 cause approximately 70% of cervical cancers globally (2). Among types associated with other HPV-related cancers, HPV 16 is most prevalent (5). Nononcogenic types can result in clinically significant disease; HPV types 6 and 11 can cause recurrent respiratory papillomatosis (a rare condition in which warts develop in the respiratory tract) and cause nearly all genital warts (6). Approximately 355,000 (range: 250,000–1 million) new cases of genital warts are estimated to occur annually (3,7,8).

Two HPV vaccines are licensed in the United States for prevention of specific HPV types and HPV-associated outcomes. In June 2006, a quadrivalent HPV vaccine (HPV4; Gardasil; Merck and Co., Inc.) was licensed by the Food and Drug Administration (FDA) for use in females aged 9–26 years for prevention of cervical cancer, cervical cancer precursors, vulvar and vaginal cancer precursors,* and anogenital warts caused by HPV types 6, 11, 16, and 18 (2). In 2009, HPV4 was licensed for use in males aged 9–26 years for genital warts prevention (10). Also in 2009, FDA licensed bivalent HPV vaccine (HPV2; Cervarix; GlaxoSmithKline) for use in females aged 9–25 years for prevention of cervical cancer and cervical cancer precursors caused by HPV types 16 and 18 (11,12). In December 2010, HPV4's indications were expanded to include prevention of anal cancer in females and males (10). Both vaccines are administered as a 3-dose series over 6 months (12).

During 2006–2011, as data on parameters including safety, efficacy, and cost-effectiveness of HPV4 and HPV2 became available for females and, later, for use of HPV4 among males, CDC's Advisory Committee on Immunization Practices (ACIP) provided national vaccination recommendations. In 2006, ACIP recommended routine use of HPV4 among females (2). In 2009, ACIP issued guidance that HPV4 could be administered to males and, in October 2011, recommended routine HPV4 vaccination for males (10). ACIP recommends routine HPV vaccination for all adolescents aged 11–12 years. For females, ACIP recommends either HPV4 or HPV2; for

* In 2008, the indications for HPV4 were expanded to include vulvar and vaginal cancers (9).

males, ACIP recommends HPV4.[†] For persons who have not initiated or completed the series, ACIP recommends vaccination for females through age 26 years and males through age 21 years (10,13).[§]

In addition to annual seasonal influenza vaccination and routine HPV vaccination, ACIP recommends routine vaccination with tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) and quadrivalent meningococcal conjugate (MenACWY) vaccines for adolescents aged 11–12 years (13). Since 2005, ACIP has recommended routine Tdap and MenACWY vaccination for preteens (14–16). For persons aged ≤18 years who are not fully immunized consistent with routine recommendations, a catch-up immunization schedule is available (13).

In 2010, national *Healthy People 2020* vaccination coverage targets of 80% were specified for adolescents aged 13–15 years for ≥1 dose Tdap, ≥1 dose MenACWY, and (among females) ≥3 doses of HPV vaccine (objectives IID-11.1, 11.3, and 11.4) (17). To increase rates of pediatric patients up-to-date with Level I preventive services, the National Quality Forum (NQF) has defined measures for Tdap, MenACWY, HPV, and influenza vaccines. The HPV vaccination measure is defined as the percentage of female adolescents aged 13 years who had 3 doses of HPV vaccine by their 13th birthday (NQF #1959) (18).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (19). Through primary prevention, increased HPV vaccine use among adolescents (measured by vaccine coverage) has the potential to diminish the substantial health and economic burdens caused by HPV-associated diseases, including cancers. This report analyzes 2011 data from the National Immunization Survey–Teen (NIS-Teen) to estimate the proportion, by sex, of adolescents aged 13–17 years who received HPV vaccination as recommended by ACIP. Public health authorities and clinicians can use these data to promote evidence-based strategies to increase HPV vaccination coverage among adolescents consistent with national recommendations and to protect adolescents against vaccine-preventable HPV-associated diseases, including cancers.

[†] HPV2 is not licensed for use in males (13).

[§] For unvaccinated or incompletely vaccinated immunocompromised males or men who have sex with men, vaccination is recommended through age 26 years (10,13).

Methods

To attain national estimates of the proportions, by sex, of adolescents who had received ≥1 dose and ≥3 doses of HPV vaccine consistent with evolving ACIP recommendations, CDC analyzed 2011 data from NIS-Teen. For this report, 2011 data were chosen as a baseline because information collection occurred after the December 2010 FDA licensure of HPV4 for an anal cancer prevention indication that included both sexes (and thus which theoretically might have influenced HPV4 coverage). Because most 2011 NIS-Teen data were collected before ACIP recommended routine male HPV4 vaccination in October 2011 (10), findings represent baseline data for monitoring that recommendation's implementation.

The 2011 NIS-Teen employed a random-digit-dialed sample of landline and cellular telephone numbers (20) to collect immunization information for adolescents aged 13–17 years residing in the 50 states, the District of Columbia, and other selected areas (21). Respondents who were parents or guardians of adolescents aged 13–17 years provided information regarding their adolescents' immunization histories, health-care use, health insurance coverage, and sociodemographics. After respondents had given their consents, questionnaires were mailed to all identified health-care providers to obtain vaccination history data from medical records, so that composite validated immunization histories could be analyzed (21). Details regarding NIS-Teen methodology, including immunization history development and weighting methods, have been described previously (22,23).

A total of 23,564 adolescents with provider-verified vaccination records were included in this report, of whom 11,236 (47.7%) were female. Of this total, data were obtained for 20,848 adolescents from completed interviews from landline sampling and for 2,716 adolescents from cellular-telephone sampling (21). The Council of American Survey Research Organizations (CASRO) landline and cellular-telephone response rates were 57.2% and 22.4%, respectively.[¶] Results are stratified by age, sex, and sociodemographic variables. Reported household incomes and numbers of persons living/staying in surveyed households were employed with 2010 Census poverty thresholds to determine income-to-poverty ratios (21,22). Vaccine financing categories included 1) entitled to the federal Vaccines for Children (VFC) program on the basis of being age <19 years and meeting at least one of the three following criteria: Medicaid eligible, American

[¶] Representing 61.5% of adolescents described through completed interviews from landline sampling, 20,848 adolescents with provider-reported vaccination data are reflected in this report. Representing 54.6% of adolescents described through completed interviews from cellular-telephone sampling, 2,716 adolescents with provider-reported vaccination data are included (21).

Indian/Alaska Native (AI/AN) descent, or underinsured and vaccinated at a federally qualified health center (FQHC) or rural health center (RHC);** 2) VFC-entitled because of being aged <19 years and uninsured; 3) privately insured (either fully insured or underinsured, but not vaccinated at either an FQHC or RHC); 4) Children's Health Insurance Program (CHIP); 5) military health care or insurance; and 6) other.

Among all adolescents with provider-reported vaccination records, CDC assessed ≥ 1 and ≥ 3 dose coverage by including vaccinations received by household interview date. To assess 3-dose series completion rates among those who received ≥ 1 dose and had sufficient time to complete the series, CDC identified the percentage of females and males who had received ≥ 3 doses among those who had received ≥ 1 HPV dose and had at least 24 weeks between first dose receipt and interview date. Among males, sample sizes limited analyses regarding receipt of ≥ 3 doses and completion status.

To account for the survey's complex sampling design, CDC analyzed data using SAS-callable SUDAAN 9.2 (Research Triangle Institute, Research Triangle Park, North Carolina). CDC employed t-tests to assess vaccination coverage differences and a weighted linear regression to assess coverage trends among females. Estimates with confidence interval (CI) widths exceeding 20 percentage points might not be reliable. Estimates were not reported if an unweighted sample size for a denominator was <30 or if the 95% CI half-width divided by the estimate was >0.6. Results were considered statistically significant at $p < 0.05$.

Results

Sociodemographic and other characteristics of sampled adolescents are provided (Table 1). Overall, among males aged 13–17 years, 8.3% had received ≥ 1 dose, and 1.3% had received ≥ 3 doses (Table 2). Among females aged 13–17 years, 53.0% had received ≥ 1 HPV vaccine dose, and 34.8% had received ≥ 3 doses (Table 2). Coverage among females increased by an average of 5 to 6 percentage points per year of age for both ≥ 1 dose and ≥ 3 doses ($p < 0.01$). Among females aged 13–15 years, for whom *Healthy People 2020* coverage targets

are specified, 30.0% (95% CI = 28.0–32.1) received ≥ 3 doses. HPV series completion among those who had ≥ 1 HPV dose and at least 24 weeks between first dose receipt and interview date was documented among 70.7% of females (Table 3) and 28.1% (95% CI = 22.0–35.0) of males.

Vaccination coverage patterns varied by racial/ethnic group, poverty status, and other sociodemographic variables depending on whether receipt of ≥ 1 dose, ≥ 3 doses, or series completion was assessed (Table 3). For both sexes, receipt of ≥ 1 dose was significantly higher among Hispanics and non-Hispanic blacks compared with non-Hispanic whites. Among females, receipt of ≥ 3 doses was higher among Hispanics compared with non-Hispanic whites (Table 3). Series completion was lower among black females compared with white females. For both sexes, coverage for ≥ 1 dose was higher among persons living in households in the lowest income-to-poverty ratio group compared with those living in households in the highest income-to-poverty ratio group. Series completion rates among females increased as income-to-poverty ratios increased. Compared with adolescents living in central city areas, ≥ 1 dose coverage for both sexes was lower among adolescents living in other areas. Although lower coverage for ≥ 3 doses was observed among females living outside a Metropolitan Statistical Area, completion rates did not differ by area. Compared with adolescents having mothers who did not complete high school, lower coverage for ≥ 1 dose was observed for males and females having mothers with a high school or college education. In contrast, series completion among females having mothers with college educations was approximately 15 percentage points higher compared with females having mothers who did not complete high school. For both sexes, coverage for ≥ 1 dose was higher among those with mothers aged ≤ 34 years compared with adolescents having mothers aged ≥ 45 years; however, ≥ 3 -dose coverage among females was lower among those with younger mothers. Series completion rates among females increased as mother's age increased (Table 3).

Among males and females, VFC entitlement because of Medicaid eligibility, AI/AN descent, or being underinsured (and vaccinated at either an FQHC or RHC) was associated with higher coverage for ≥ 1 dose compared with privately insured, non-VFC-entitled adolescents (Table 3). Among females, the magnitude of the difference between these groups dropped from a 15 percentage point difference for ≥ 1 dose to a 4.6 percentage point difference for ≥ 3 doses. Series completion rates were higher among privately insured females. Similar patterns were evident when CHIP and private insurance estimates were compared. For ≥ 1 dose coverage among females, there was no statistically significant difference between those who were privately insured and those who were

** Children aged ≤ 18 years who are Medicaid-eligible, uninsured, or American Indian/Alaska Native (as defined by the Indian Health Care Improvement Act) are entitled to receive vaccines from providers through the VFC program. Children categorized as underinsured (because their health plans do not include coverage for recommended vaccinations) may receive VFC vaccines if they are served by a rural health clinic or federally qualified health center or under an approved deputization agreement. Additional information is available at <http://www.cdc.gov/vaccines/programs/vfc/providers/eligibility.html>. For the purposes of this analysis, adolescents having private insurance and meeting VFC entitlement criteria were categorized as VFC-entitled. Underinsured adolescents were those with private insurance whose parents reported vaccination-related costs (other than copayments and office visit costs).

TABLE 1. Characteristics of participating adolescents aged 13–17 years* — National Immunization Survey–Teen, United States, 2011

Sociodemographic characteristic	Total			Female			Male		
	No.	Weighted proportion		No.	Weighted proportion		No.	Weighted proportion	
		% estimate	(95% CI)		% estimate	(95% CI)		% estimate	(95% CI)
Age at interview (yrs)	23,564			11,236			12,328		
13	4,763	19.5	(18.6–20.4)	2,239	19.9	(18.7–21.3)	2,524	19.1	(17.9–20.3)
14	4,842	19.9	(19.1–20.9)	2,282	19.9	(18.6–21.3)	2,560	20.0	(18.8–21.2)
15	4,750	20.6	(19.7–21.6)	2,329	20.8	(19.4–22.2)	2,421	20.5	(19.2–21.8)
16	4,774	21.1	(20.2–22.1)	2,252	21.1	(19.7–22.6)	2,522	21.2	(19.9–22.5)
17	4,435	18.8	(17.9–19.7)	2,134	18.3	(17.0–19.5)	2,301	19.3	(18.1–20.6)
Race/Ethnicity	23,564			11,236			12,328		
White, non-Hispanic	15,970	57.3	(56.1–58.4)	7,555	56.2	(54.5–57.9)	8,415	58.3	(56.6–59.9)
Black, non-Hispanic	2,408	14.4	(13.6–15.3)	1,154	14.8	(13.6–16.2)	1,254	14.0	(12.9–15.2)
Hispanic†	3,234	20.0	(19.0–21.1)	1,587	21.1	(19.6–22.8)	1,647	19.0	(17.5–20.5)
AI/AN	296	0.9	(0.7–1.1)	151	0.8	(0.6–1.0)	145	0.9	(0.7–1.3)
Asian	651	3.3	(2.8–3.8)	328	3.2	(2.6–4.0)	323	3.4	(2.7–4.2)
Multiple race and other	1,005	4.1	(3.7–4.6)	461	3.8	(3.2–4.5)	544	4.4	(3.8–5.1)
Income-to-poverty ratio	23,564			11,236			12,328		
<133%	5,051	31.5	(30.4–32.7)	2,464	32.3	(30.6–34.0)	2,587	30.8	(29.2–32.4)
133%–<322%	7,155	30.9	(29.9–32.0)	3,338	30.4	(28.9–32.0)	3,817	31.4	(30.0–32.9)
322%–<503%	5,363	18.4	(17.6–19.2)	2,528	18.1	(17.0–19.3)	2,835	18.6	(17.5–19.7)
≥503%	5,995	19.2	(18.4–20.0)	2,906	19.2	(18.0–20.3)	3,089	19.2	(18.1–20.3)
MSA	23,564			11,236			12,328		
MSA, Central City	9,232	39.8	(38.6–40.9)	4,388	39.9	(38.2–41.5)	4,844	39.7	(38.1–41.3)
MSA, non-Central City	8,955	44.4	(43.2–45.5)	4,291	44.1	(42.4–45.7)	4,664	44.6	(43.1–46.2)
Living outside an MSA	5,377	15.9	(15.2–16.6)	2,557	16.1	(15.1–17.1)	2,820	15.7	(14.8–16.7)
Mother's education	23,564			11,236			12,328		
Less than high school	2,227	13.8	(12.9–14.8)	1,094	14.0	(12.8–15.4)	1,133	13.6	(12.3–15.0)
High school	4,581	25.3	(24.3–26.4)	2,145	24.8	(23.3–26.4)	2,436	25.8	(24.4–27.3)
More than high school, some college	6,463	26.8	(25.9–27.8)	3,083	27.3	(25.9–28.8)	3,380	26.4	(25.1–27.8)
College graduate	10,293	34.1	(33.0–35.1)	4,914	33.9	(32.4–35.4)	5,379	34.2	(32.8–35.6)
Mother's marital status	23,363			11,130			12,233		
Married	17,690	66.9	(65.8–68.1)	8,373	66.4	(64.7–68.1)	9,317	67.4	(65.8–69.0)
Divorced/widowed/separated	3,989	22.5	(21.5–23.5)	1,904	22.3	(20.9–23.8)	2,085	22.7	(21.2–24.1)
Never married	1,684	10.6	(9.8–11.4)	853	11.3	(10.1–12.6)	831	9.9	(8.9–11.0)
Mother's age group (yrs)	23,564			11,236			12,328		
≤34	1,716	10.9	(10.1–11.7)	842	11.5	(10.3–12.8)	874	10.3	(9.3–11.5)
35–44	9,674	44.9	(43.7–46.0)	4,547	44.2	(42.6–45.9)	5,127	45.5	(43.9–47.1)
≥45	12,174	44.3	(43.1–45.4)	5,847	44.3	(42.7–46.0)	6,327	44.2	(42.6–45.7)
Vaccine financing	23,559			11,233			12,326		
Privately insured (not VFC-entitled) [§]	14,705	52.9	(51.7–54.1)	6,969	52.8	(51.1–54.5)	7,736	52.9	(51.3–54.6)
VFC-entitled—Medicaid eligible/AIAN/ underinsured [¶]	6,211	33.8	(32.7–35.0)	3,010	34.2	(32.5–35.9)	3,201	33.5	(31.9–35.1)
VFC-entitled—uninsured**	1,055	5.8	(5.3–6.4)	497	5.5	(4.8–6.4)	558	6.2	(5.3–7.1)
CHIP	715	4.0	(3.5–4.6)	325	4.2	(3.5–5.1)	390	3.9	(3.2–4.6)
Military health care or insurance	651	2.5	(2.1–2.9)	322	2.4	(1.9–3.2)	329	2.5	(2.0–3.1)
Other	222	0.9	(0.7–1.2)	110	0.9	(0.6–1.2)	112	1.0	(0.7–1.3)

See table footnotes on page 65.

VFC entitled and uninsured; however, for ≥3 dose coverage among females, 34.1% of privately insured adolescent females were vaccinated compared with only 20.3% ($p<0.05$) of VFC-entitled uninsured.

More than 70% of males and females with history of having had ≥1 dose received their initial HPV doses in pediatric settings (Table 1). Among female adolescents for whom HPV4 was licensed and available when they were aged 11–12 years, coverage for ≥1 dose and ≥3 doses as well as series completion were higher for those who had a provider-reported 11–12 year

preventive visit (Table 3). For receipt of ≥1 dose among both sexes and ≥3 doses among females, higher coverage rates were observed among adolescents whose parents reported having received providers' vaccination recommendations (Table 3).

Discussion

The results of this survey, which was conducted approximately 5 years after HPV4 was licensed in 2006 for use in females, demonstrate that approximately half of females aged 13–17

TABLE 1. (Continued) Characteristics of participating adolescents aged 13–17 years* — National Immunization Survey–Teen, United States, 2011

Sociodemographic characteristic	Total			Female			Male		
	No.	Weighted proportion		No.	Weighted proportion		No.	Weighted proportion	
		% estimate	(95% CI)		% estimate	(95% CI)		% estimate	(95% CI)
Specialty at facility where received first HPV vaccine dose	6,394			5,441			953		
Pediatrics	4,601	72.3	(70.1–74.4)	3,887	71.6	(69.2–73.9)	714	76.7	(71.6–81.2)
Family practice	1,083	16.2	(14.5–18.0)	959	17.0	(15.2–19.1)	124	10.9	(8.1–14.5)
General practice	60	1.1	(0.7–1.7)	51	1.1	(0.7–1.9)	—††		
Internal medicine	—			—			—		
Obstetrics/Gynecology	37	0.8	(0.5–1.4)	35	0.8	(0.5–1.5)	—		
Other	597	9.3	(8.0–10.8)	494	9.0	(7.6–10.7)	103	10.9	(7.9–14.9)
Had a preventive care visit at age 11 or 12 years following relevant FDA licensures for HPV4^{§§}	23,564			11,236			12,328		
Yes	6,923	27.2	(26.2–28.2)	4,760	39.3	(37.7–41.0)	2,163	15.6	(14.6–16.7)
No	8,599	38.1	(37.0–39.3)	6,320	59.3	(57.7–60.9)	2,279	18.0	(16.8–19.3)
Aged ≥13 years on or after dates of relevant HPV4 licensures	8,042	34.7	(33.6–35.8)	156	1.3	(1.0–1.8)	7,886	66.4	(64.9–67.9)
Received provider recommendation for vaccination	22,830			10,903			11,927		
Yes	8,582	36.0	(34.9–37.1)	6,748	58.8	(57.1–60.5)	1,834	14.2	(13.1–15.4)
No	14,248	64.0	(62.9–65.1)	4,155	41.2	(39.5–42.9)	10,093	85.8	(84.6–86.9)
Overall total	23,564			11,236			12,328		

Abbreviations: AI/AN = American Indian/Alaska Native; CHIP = Children's Health Insurance Program; CI = confidence interval; FDA = U.S. Food and Drug Administration; FQHC = federally qualified health center; HPV = human papillomavirus; HPV4 = quadrivalent HPV vaccine; MSA = metropolitan statistical area; RHC = rural health center; VFC = Vaccines for Children program.

* Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999.

† Persons of Hispanic ethnicity can be of any race or combination of races.

§ Either fully insured or underinsured but not vaccinated at either an FQHC or RHC.

¶ VFC-entitled based on age <19 years and at least one of the following three criteria: Medicaid eligible, AI/AN descent (as defined by the Indian Health Care Improvement Act), or underinsured and vaccinated at an FQHC or RHC.

** VFC-entitled due to being aged <19 years and uninsured.

†† Estimate not reported because unweighted sample size for the denominator was <30 or 95% CI half-width/estimate was >0.6.

§§ Data are based on provider reports. Categories are mutually exclusive. Female adolescents who were aged ≤12 years at the time of initial HPV4 vaccine licensure (June 8, 2006) and had a preventive care visit at age 11 or 12 years are included in the “yes” category. Male adolescents who were aged ≤12 years at the time of the October 16, 2009, FDA licensure of HPV4 for prevention of genital warts in males and had a preventive health care visit at age 11 or 12 years are included in the “yes” category. Males and females who are included in the “no” category were aged ≤12 years at the time of the respective licensures, but did not have a provider-reported preventive visit at age 11 or 12 years. The third category includes adolescents who were aged ≥13 years at the time of either the 2006 licensure (females) or the 2009 licensure (males) and thus had already passed the period for their recommended preventive health visit at age 11 or 12 years.

TABLE 2. Estimated human papillomavirus vaccination* coverage among adolescents aged 13–17 years,† by age at interview — National Immunization Survey–Teen, United States, 2010 and 2011

HPV* vaccine receipt	Age group (yrs) at interview for 2010 and 2011 NIS-Teen													
	Age (yrs) at interview for 2011 NIS-Teen					2010		2011						
	13 (n = 4,763)	14 (n = 4,842)	15 (n = 4,750)	16 (n = 4,774)	17 (n = 4,435)	13–17 (n = 19,257)		13–17 (n = 23,564)						
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)				
Female														
≥1 dose	41.6	(38.0–45.2)	45.5	(41.9–49.1)	56.4	(52.6–60.1) [§]	59.2	(55.4–62.8) [§]	62.8	(59.4–66.1) [§]	48.7	(46.9–50.5)	53.0	(51.4–54.7) [¶]
≥3 doses	22.9	(20.1–26.0)	29.2	(26.0–32.5) [§]	37.8	(33.8–41.9) [§]	40.0	(36.4–43.8) [§]	44.5	(40.8–48.3) [§]	32.0	(30.3–33.6)	34.8	(33.2–36.4) [¶]
Male														
≥1 dose	9.8	(7.6–12.5)	8.2	(6.4–10.4)	7.4	(5.8–9.3)	9.8	(7.3–12.9)	6.2	(5.0–7.7) [§]	1.4	(1.1–1.8)	8.3	(7.4–9.3) [¶]
≥3 doses	1.6	(1.0–2.7)	1.8	(1.0–3.3)	0.9	(0.5–1.4)	1.3	(0.8–2.1)	1.0	(0.7–1.6)	—**	—	1.3	(1.0–1.7) [¶]

Abbreviations: CI = confidence interval; HPV = human papillomavirus; NIS = National Immunization Survey.

* Either quadrivalent or bivalent HPV vaccine. Some adolescents might have received more than the 3 recommended HPV doses. Most point estimates presented in this table have been published previously (Sources: CDC. National and state vaccination coverage among adolescents aged 13–17 years—United States, 2011. MMWR 2012;61:671–7; CDC. National and state vaccination coverage among adolescents aged 13 through 17 years—United States, 2010. MMWR 2011;60:1117–23).

† Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999. Percentage reported among females (n = 11,236) and males (n = 12,328).

§ Statistically significant difference (p<0.05) in estimated vaccination coverage by age, with adolescents aged 13 years as referent group.

¶ Statistically significant increase (p<0.05) compared with 2010 NIS-Teen overall estimates.

** Estimate not reported because unweighted sample size for the denominator was <30 or 95% CI half-width/estimate was >0.6.

TABLE 3. Estimated human papillomavirus (HPV) vaccination coverage* among adolescents aged 13–17 years,† by doses received‡ and selected sociodemographic characteristics — National Immunization Survey–Teen, United States, 2011

Sociodemographic characteristic	Females									Males		
	≥1 dose			≥3 doses			Series completion¶			≥1 dose		
	Vaccination coverage			Vaccination coverage			Vaccination coverage			Vaccination coverage		
	%	(95% CI)**	p value	%	(95% CI)**	p value	%	(95% CI)**	p value	%	(95% CI)**	p value
Age at interview (yr)												
13††	41.6	(38.0–45.2)		22.9	(20.1–26.0)		63.6	(57.7–69.0)		9.8	(7.6–12.5)	
14	45.5	(41.9–49.1)	0.126	29.2	(26.0–32.5)	0.005	72.1	(66.9–76.8)	0.026	8.2	(6.4–10.4)	0.317
15	56.4	(52.6–60.1)	<0.001	37.8	(33.8–41.9)	<0.001	70.8	(65.6–75.5)	0.059	7.4	(5.8–9.3)	0.111
16	59.2	(55.4–62.8)	<0.001	40.0	(36.4–43.8)	<0.001	71.0	(65.8–75.8)	0.053	9.8	(7.3–12.9)	0.990
17	62.8	(59.4–66.1)	<0.001	44.5	(40.8–48.3)	<0.001	74.0	(68.8–78.5)	0.006	6.2	(5.0–7.7)	0.011
Race/Ethnicity												
White, non-Hispanic††	47.5	(45.6–49.4)		33.0	(31.3–34.8)		74.8	(72.2–77.2)		5.6	(4.8–6.5)	
Black, non-Hispanic	56.0	(51.2–60.6)	0.001	31.7	(27.3–36.5)	0.603	60.8	(53.9–67.2)	<0.001	10.6	(8.3–13.4)	<0.001
Hispanic§§	65.0	(60.8–69.0)	<0.001	41.6	(37.2–46.2)	0.001	69.4	(63.6–74.7)	0.085	14.9	(11.6–18.9)	<0.001
AI/AN	59.4	(47.2–70.6)**	0.054	37.8	(27.1–49.8)**	0.425	71.1	(56.3–82.5)**	0.599	—¶¶	—	
Asian	55.8	(44.9–66.2)**	0.138	35.0	(24.3–47.5)**	0.748	70.5	(53.5–83.2)**	0.587	—	—	
Multiple race and other	52.7	(44.2–61.1)	0.245	33.9	(26.3–42.3)	0.844	67.1	(55.2–77.1)**	0.184	8.0	(5.1–12.4)	0.195
Income-to-poverty ratio												
<133%	60.5	(57.2–63.6)	0.003	36.8	(33.5–40.2)	0.090	64.7	(60.3–69.0)	<0.001	13.0	(10.8–15.6)	<0.001
133%–<322%	48.8	(45.8–51.9)	0.034	30.4	(27.7–33.3)	<0.001	68.2	(63.3–72.7)	<0.001	7.8	(6.3–9.6)	0.017
322%–<503%	46.2	(42.8–49.6)	0.002	32.2	(29.2–35.4)	<0.001	74.2	(69.4–78.4)	0.001	4.2	(3.3–5.4)	0.200
≥503%††	53.6	(50.4–56.7)		40.8	(37.6–44.0)		83.2	(80.0–85.9)		5.3	(4.2–6.7)	
MSA												
MSA, Central City††	56.9	(54.1–59.7)		37.1	(34.3–40.0)		69.4	(65.5–73.0)		10.3	(8.8–12.0)	
MSA, non-Central City	53.1	(50.6–55.6)	0.044	35.4	(33.1–37.9)	0.377	72.7	(69.2–76.0)	0.196	7.2	(5.8–8.9)	0.006
Living outside an MSA	43.1	(39.8–46.5)	<0.001	27.3	(24.4–30.3)	<0.001	68.5	(63.3–73.2)	0.778	6.4	(5.0–8.1)	0.001
Mother's education												
Less than high school††	64.7	(59.8–69.3)		38.5	(33.5–43.7)		64.3	(57.8–70.4)		15.8	(11.8–20.8)	
High school	52.9	(49.3–56.6)	<0.001	32.1	(28.7–35.7)	0.043	65.3	(59.8–70.5)	0.815	8.0	(6.5–9.7)	0.001
More than high school, some college	52.5	(49.5–55.6)	<0.001	34.3	(31.5–37.3)	0.164	70.0	(65.7–74.1)	0.144	8.4	(6.8–10.4)	0.003
College graduate	48.7	(46.1–51.2)	<0.001	35.6	(33.1–38.3)	0.332	79.1	(76.0–82.0)	<0.001	5.4	(4.5–6.5)	<0.001
Mother's marital status												
Married††	51.2	(49.3–53.1)		35.1	(33.2–37.0)		74.0	(71.3–76.6)		7.6	(6.5–8.8)	
Divorced/widowed/separated	54.1	(50.4–57.9)	0.173	33.5	(30.0–37.1)	0.436	67.4	(62.4–72.1)	0.020	9.6	(7.6–12.0)	0.125
Never married	63.6	(57.8–69.0)	<0.001	37.0	(31.4–43.0)	0.546	60.7	(52.7–68.2)	0.002	9.8	(7.3–13.0)	0.164
Mother's age group (yrs)												
≤34	62.6	(56.9–68.0)	<0.001	28.3	(23.4–33.9)	0.005	51.9	(44.1–59.7)	<0.001	12.4	(8.9–16.8)	0.014
35–44	52.0	(49.5–54.6)	0.775	34.7	(32.2–37.2)	0.268	71.0	(67.6–74.3)	0.040	8.5	(7.3–9.9)	0.158
≥45††	51.5	(49.2–53.9)		36.6	(34.3–39.0)		75.9	(72.6–78.9)		7.1	(5.8–8.7)	
Vaccine financing												
Privately insured (not VFC-entitled)††,***	47.4	(45.4–49.5)		34.1	(32.2–36.1)		78.4	(75.7–80.9)		4.6	(3.9–5.4)	
VFC-entitled—Medicaid eligible/AI/AN/underinsured†††	62.4	(59.4–65.3)	<0.001	38.7	(35.6–41.9)	0.015	66.1	(62.0–70.0)	<0.001	13.5	(11.4–15.9)	<0.001
VFC-entitled—uninsured§§§	43.3	(36.1–50.9)	0.297	20.3	(14.9–27.0)	<0.001	50.3	(38.2–62.3)**	<0.001	—	—	
CHIP	58.7	(48.8–67.9)	0.025	31.0	(22.9–40.5)	0.500	57.3	(43.1–70.5)**	0.004	13.1	(8.0–20.5)	0.008
Military health care or insurance	57.6	(45.8–68.7)**	0.091	39.5	(26.4–54.3)**	0.467	70.2	(52.8–83.3)**	0.313	—	—	
Other	45.8	(29.8–62.8)**	0.856	16.9	(9.4–28.7)	0.001	—	—		—	—	

See table footnotes on page 67.

years sampled in 2011 had not yet received the recommended first HPV vaccine dose, and nearly two thirds had not received the ≥3 doses required for series completion. Among females who initiated the series, approximately 30% still needed to complete it. Among males, 2011 coverage estimates primarily reflect

2009 licensure and policy (i.e., HPV4's initial licensure for males and ACIP's guidance that HPV4 could be administered to males aged 9–26 years); these 2011 data provide a baseline for monitoring implementation of the October 2011 routine HPV4 vaccination recommendation for males.

TABLE 3. (Continued) Estimated human papillomavirus (HPV) vaccination coverage* among adolescents aged 13–17 years,[†] by doses received[‡] and selected sociodemographic characteristics — National Immunization Survey–Teen, United States, 2011

Sociodemographic characteristic	Females									Males		
	≥1 dose			≥3 doses			Series completion [¶]			≥1 dose		
	Vaccination coverage			Vaccination coverage			Vaccination coverage			Vaccination coverage		
	%	(95% CI)**	p-value	%	(95% CI)**	p-value	%	(95% CI)**	p-value	%	(95% CI)**	p-value
Specialty at facility where received first HPV dose												
Pediatrics ^{††}	100.0			69.4	(66.6–72.0)		74.6	(71.8–77.1)		100.0		
Family practice	100.0			66.8	(60.8–72.2)	0.422	70.9	(64.8–76.3)	0.261	100.0		
General practice	100.0			—	—		—	—		—	—	
Internal medicine	—	—		—	—		—	—		—	—	
Obstetrics/Gynecology	100.0			—	—		—	—		—	—	
Other	100.0			49.1	(40.2–58.0)	<0.001	54.7	(45.9–63.3)	<0.001	100.0		
Had a preventive care visit at age 11 or 12 years following relevant FDA licensures for HPV4^{¶¶¶}												
Yes ^{††}	60.0	(57.5–62.4)		43.8	(41.2–46.4)		78.8	(75.9–81.4)		8.8	(6.9–11.2)	
No	48.2	(46.0–50.5)	<0.001	28.4	(26.4–30.6)	<0.001	63.6	(60.0–67.0)	<0.001	9.9	(7.6–12.7)	0.522
Aged ≥13 years on or after dates of relevant HPV4 licensures	60.9	(47.8–72.6)**	0.893	51.6	(38.4–64.6)**	0.263	86.7	(76.2–93.0)	0.075	7.7	(6.6–9.0)	0.393
Received provider recommendation for vaccination												
Yes ^{††}	63.8	(61.7–65.8)		42.3	(40.2–44.4)		72.2	(69.5–74.7)		36.0	(31.9–40.4)	
No	37.6	(34.8–40.5)	<0.001	23.6	(21.0–26.3)	<0.001	66.7	(61.5–71.5)	0.056	3.7	(3.0–4.5)	<0.001
Overall total	53.0	(51.4–54.7)		34.8	(33.2–36.4)		70.7	(68.4–73.0)		8.3	(7.4–9.3)	

Abbreviations: AI/AN = American Indian/Alaska Native; CHIP = Children's Health Insurance Program; CI = confidence interval; FDA = U.S. Food and Drug Administration; FQHC = federally qualified health center; HPV = human papillomavirus; HPV4 = quadrivalent HPV vaccine; MSA = metropolitan statistical area; RHC = rural health center; VFC = Vaccines for Children program.

* Human papillomavirus vaccine, either quadrivalent or bivalent. Some adolescents might have received more than the 3 recommended HPV doses. Some point estimates related to coverage by age and race/ethnicity, respectively, that are presented in this table have been previously published (21).

[†] Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999.

[‡] Due to sample sizes, estimates for males are presented only for coverage with ≥1 dose.

[¶] To assess 3-dose HPV vaccination series completion rates among those who received ≥1 dose and had sufficient time to complete the series, CDC identified the percent of females who received 3 doses among those who had at least 1 HPV dose and at least 24 weeks between first dose receipt and interview date.

** Estimates with 95% CI widths >20 might not be reliable.

^{††} Referent group for pairwise comparisons.

^{§§} Persons of Hispanic ethnicity can be of any race or combination of races.

^{¶¶} Estimate not reported because unweighted sample size for the denominator was <30 or 95% CI half-width/estimate was >0.6.

^{***} Either fully insured or underinsured but not vaccinated at either an FQHC or an RHC.

^{†††} VFC-entitled based on age <19 years and at least one of the following three criteria: Medicaid eligible, AI/AN descent (as defined by the Indian Health Care Improvement Act), or underinsured and vaccinated at an FQHC or RHC.

^{§§§} VFC-entitled due to being aged <19 years and uninsured.

^{¶¶¶} Data are based on provider reports. Categories are mutually exclusive. Female adolescents who were aged ≤12 years at the time of initial HPV4 vaccine licensure (June 8, 2006) and had a preventive care visit at age 11 or 12 years are included in the "yes" category. Male adolescents who were aged ≤12 years at the time of the October 16, 2009, FDA licensure of HPV4 for prevention of genital warts in males and had a preventive health care visit at age 11 or 12 years are included in the "yes" category. Males and females who are included in the "no" category were aged ≤12 years at the time of the respective licensures, but did not have a provider-reported preventive visit at age 11 or 12 years. The third category includes adolescents who were aged ≥13 years at the time of either the 2006 licensure (females) or the 2009 licensure (males) and thus had already passed the period for their recommended preventive health visit at age 11 or 12 years.

At only 30.0%, coverage among females aged 13–15 years is substantially below the *Healthy People 2020* target of 80% coverage for ≥3 HPV vaccine doses. In contrast, in 2011, coverage estimates among all adolescents aged 13–15 years for ≥1 dose Tdap and ≥1 dose MenACWY were 80.5% and 71.5%, respectively (21), demonstrating achievement of the *Healthy People 2020* target for Tdap coverage and highlighting that 80% vaccination coverage is attainable among adolescents. These findings also indicate that opportunities are being missed to deliver HPV vaccine with other routinely recommended vaccines.

With some fluctuation, analyses of 2008–2010 NIS-Teen data (24–27) have shown higher HPV vaccination series initiation rates among adolescent females who were black, Hispanic, or living below poverty, yet lower rates for series

completion among these groups. In 2011, although receipt of ≥1 dose was significantly higher among black and Hispanic adolescents compared with whites, series completion among females was significantly lower among blacks than whites. In addition, receipt of ≥1 dose was significantly higher among adolescents with household incomes <133% of the federal poverty level (FPL) compared with those having household incomes ≥503% of FPL, while series completion among females was significantly lower among those with household incomes <133% of FPL compared with those having household incomes ≥503% of FPL. The observation of higher vaccination coverage for ≥1 HPV vaccine dose among adolescents living in poverty might be related to the effectiveness of the VFC program in facilitating vaccination of these adolescents consistent

with ACIP recommendations. However, the availability of vaccines at no cost to families for vaccines through the VFC program might not be sufficient to transcend other barriers to vaccination. This might account for findings related to series completion. Higher series completion among females in those having household incomes $\geq 503\%$ of FPL might suggest that these adolescents' families have resources to transcend barriers to completing the 3-dose series that persons with household incomes $< 133\%$ of FPL might not. For example, adolescents belonging to higher income households might have better access to transportation compared with adolescents with household incomes $< 133\%$ of FPL. Understanding these barriers is important to achieving the increased HPV vaccination series completion rates that are needed, especially among groups with higher cervical cancer rates (28).

To increase use of universally recommended vaccinations, CDC's *Community Guide to Preventive Services* includes a systematic review of evidence available to support implementation of specific interventions (29). As examples, the *Guide* suggests that improved vaccination rates can be achieved by decreasing client out-of-pocket costs (e.g., through providing insurance coverage) (30). Immunization providers also can reduce clients' out-of-pocket costs by participating in the VFC program, which is administered by CDC in partnership with federal immunization awardees and enrolled VFC immunization providers. By supplying vaccines at no purchase cost through enrolled VFC immunization providers, the VFC program helps families of children who might not have other means of accessing vaccines (31). Whereas some *Guide* recommendations, including reducing out-of-pocket costs, have strong evidence of effectiveness among children, adolescents, and adults, evidence bases available for development of some *Guide* recommendations have not included adolescent vaccination studies consistently. However, more data pertaining directly to adolescent vaccination are accruing. Examples include recently published findings demonstrating reminder/recall effectiveness among adolescents in Denver private practices and school-based health centers (SBHCs) (32,33).

Published studies consistently indicate that HPV vaccination of girls aged 12 years in the United States is cost-effective (34,35). However, existing literature reveals less agreement regarding the cost-effectiveness of HPV vaccination of boys. Most models suggest that male HPV vaccination might be cost-effective, particularly if coverage among females is low and if analyses include all potential vaccination health benefits (34,35). Evidence substantiating HPV vaccination's effectiveness is becoming available in other countries (36,37) and domestically, especially for early outcomes (e.g., HPV type prevalence and genital warts).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care, and places a greater emphasis on prevention (38). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of the U.S. Preventive Services Task Force graded A (strongly recommended) or B (recommended) (39); 2) vaccinations recommended by ACIP (40); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by the Health Resources and Services Administration (HRSA) and the American Academy of Pediatrics (41) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (42); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (43). ACIP recommends routine HPV vaccination for all children aged 11–12 years; recommendations for persons who have not initiated or completed the vaccine series vary by sex but can extend through age 26 years (10,13). Per ACIP recommendations and ACIP-approved VFC resolutions, state Medicaid programs cover HPV vaccination as part of the Early and Periodic Screening, Diagnostic and Treatment benefit (44).

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.^{††} Federal tax credits are available on a sliding scale to assist those living at 100%–400% of FPL who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including HPV vaccination for ACIP-recommended groups.

ACA contains additional provisions that might promote administration and acceptance of HPV vaccine and other vaccines recommended for adolescents. ACA § 10503 expands access to primary care by establishing a new mandatory fund for community health centers (CHCs), which provide health-care services to uninsured and underserved populations. This

^{††} The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

funding might help increase access to vaccination at CHCs by underinsured children who are eligible to receive VFC-purchased vaccines in those settings. Also, in 2011, through ACA § 4101, approximately \$95 million in federal grants to establish 278 SBHCs became available (45). Although this funding expands SBHCs from a baseline of only approximately 2,000 nationally, this increase might be important for vulnerable populations, including low-income and uninsured adolescents (46), who might not have “medical homes.”

Although ACA promises to expand access to vaccination services for many persons, including the uninsured, immunization stakeholders will need to collaborate to promote public and provider awareness of new and existing policies and programs that promote immunization consistent with ACIP recommendations. Furthermore, it is important for immunization providers to understand the importance of strongly recommending HPV vaccination and of providing vaccines, including HPV vaccine, at every opportunity in the absence of a clinical contraindication (47,48).

Limitations

The findings in this report are subject to at least three limitations. First, response rates were low. The cellular telephone household response rate was only 22.4%, and the landline household response rate was 57.2%. Only 54.6% (cellular telephones) and 61.5% (landline) of those with completed household interviews also had adequate provider data. Analyses included only adolescents whose providers submitted sufficient vaccination information for vaccination status determination. After weighting adjustments, nonresponse and noncoverage bias might have remained. Increases in coverage estimates of approximately 3 percentage points for Tdap, 2 percentage points for MenACWY, and 6 percentage points among females for HPV vaccination initiation might have resulted, on the basis of a total survey error model with comparison to provider-reported data obtained from a sample of National Health Interview Survey participants. Estimates of bias do not include vaccination status errors (e.g., underascertainment from incomplete vaccination provider identification and unknown medical record completeness) and do not address potential differential noncoverage or nonresponse bias over time (49). Second, weighted linear regression analyses did not account for methodologic changes in sampling frames. Although vaccination estimates from landline only (2006–2010) and dual sampling frames (2011–2012) might not be comparable, prior methodologic assessment suggests that the addition of cellular telephone numbers beginning in 2011 should have had limited effects on annual national coverage estimates (20).

Finally, estimates for racial/ethnic populations with sample sizes <1,000 might be unreliable. For HPV coverage analyses by sex, small sample sizes decrease the power to detect differences (50).

Conclusion

HPV vaccination has the potential to decrease substantial health and economic burdens caused by HPV-associated diseases, including cancers. At only 30.0% in 2011, coverage among females aged 13–15 years is far short of the *Healthy People 2020* target of 80% coverage for ≥3 HPV vaccine doses. If health-care reform implementation expands adolescents' access to primary care and vaccination services, it could facilitate achievement of national vaccination coverage goals and, ultimately, reduce the substantial burden of HPV-associated diseases and cancers in the U.S. population.

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Tobacco Use Screening and Cessation Assistance During Physician Office Visits Among Persons Aged 11–21 Years — National Ambulatory Medical Care Survey, United States, 2004–2010

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Introduction

Tobacco use continues to be the leading cause of preventable disease and death in the United States. Cigarette smoking accounts for approximately 480,000 premature deaths annually and approximately \$130 billion in direct medical expenses and \$150 billion in lost productivity in the United States each year (1). Approximately 88% of adults who smoke daily began smoking by the age of 18 years (2). Although tobacco cessation is beneficial at any age, intervening as early as possible is important to maximize potential health benefits. After years of steady progress in decreasing smoking prevalence, decreases in smoking among youths and young adults have slowed in recent years (2). In 2011, a total of 18.1% of U.S. high school students in the United States were current cigarette smokers, and 49.9% of these smokers had tried to quit in the past 12 months (3). The proportion of youth cigarette smokers who tried to quit smoking in the past year decreased from 57.4% in 2001 to 49.9% in 2011 (3).

Given these recent trends, continued and enhanced tobacco control efforts are needed to prevent and reduce tobacco use. Both population-based and clinical smoking prevention and cessation interventions are effective in reducing youth and adult smoking (4,5). Moreover, because daily smoking increases dramatically from early adolescence into young adulthood and an estimated 60%–85% of young tobacco users are likely to have made at least one unsuccessful quit attempt (2), a focus on youth and young adult cessation interventions might have a major impact on the prevalence of tobacco use. Primary health-care providers should assess tobacco use among their adolescent patients and counsel users to help them quit, especially because a large proportion of adolescents and young adults make annual visits to a physician's office (4,6).

The 2008 update to the U.S. Public Health Service (PHS) Clinical Practice Guideline for Treating Tobacco Use and Dependence recommends that clinicians ask pediatric and adolescent patients about tobacco use and provide a strong

message regarding the importance of abstaining from tobacco use (strength of evidence rated C*) (4). The guideline also recommends that adolescent smokers should be provided with counseling interventions to help them quit smoking because evidence indicates that cessation counseling is an effective treatment for this population (strength of evidence rated B†) (4). Finally, the guideline recommends that to protect children from secondhand smoke exposure, clinicians ask parents about tobacco use and offer parents who smoke cessation advice and assistance, a guideline that is based on evidence that counseling delivered in pediatric settings increases abstinence among parents who smoke (strength of evidence rated B) (4). The guideline does not recommend use of cessation medications for adolescent smokers because of a lack of evidence that these medications promote long-term smoking abstinence in this population (4). The American Academy of Pediatrics (AAP) also recommends that pediatricians discuss substance use with youths during office visits (7).

Healthy People 2020 tobacco use objective TU-7 calls for increasing the proportion of adolescent smokers in grades 9 through 12 who attempted to quit in the past year to 64.0% from a baseline of 58.5% in 2009 (8). *Healthy People 2020* objectives for health systems changes related to tobacco cessation among persons aged ≥18 years include increasing tobacco use screening and cessation counseling in office-based ambulatory care settings (objectives TU-9.1 and TU-10.1). In addition, the National Quality Forum (NQF) has endorsed specific clinical quality measures[§] on tobacco use assessment and tobacco cessation intervention, which include 1) the percentage of patients aged

* Strength of evidence, C. Important clinical situations in which the panel achieved consensus on the recommendation in the absence of relevant randomized controlled trials.

† Strength of evidence, B. Although some evidence from randomized clinical trials supported the recommendation, the scientific support was not optimal. For instance, few randomized trials existed, the trials that did exist were somewhat inconsistent, or the trials were not directly relevant to the recommendation.

§ Additional information is available at http://www.qualityforum.org/Measures_List.aspx.

≥18 years who have been seen for at least two office visits and were asked about tobacco use one or more times within 24 months (NQF #0028a) and 2) the percentage of patients aged ≥18 years identified as tobacco users within the past 24 months and who have been seen for at least two office visits and received a cessation intervention (NQF #0028b). Another NQF-endorsed clinical quality measure consists of assessing the percentage of patients aged ≥18 years who are currently smokers and who were seen by a health-care provider and advised to quit and the percentage of patients whose practitioner recommended or discussed smoking cessation medications, methods, or strategies (NQF #0027). Public health agencies play an important role in increasing the use of clinical preventive services by educating health-care systems and providers about effective treatments, collaborating with stakeholders to conduct programs to improve use of these services, and identifying and implementing policies that improve the use of these services (e.g., policies for a range of recommended clinical preventive services, such as coverage for tobacco cessation services and medications [4]; vaccinations of adults and children [9]; counseling, screening, and prevention of human immunodeficiency virus [HIV] infection and sexually transmitted diseases [10]; and prevention and control of health-care-associated infections) (4,5,11,12).

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (13). This report analyzes 2004–2010 combined data from the National Ambulatory Medical Care Survey (NAMCS) to determine the proportion of physician office visits for patients aged 11–21 years in which screening for tobacco use and tobacco cessation assistance (tobacco counseling, prescribing or ordering tobacco cessation medication, or both) occurred. Public health authorities and clinicians can use these data to identify population groups that might require additional strategies to access services to prevent and reduce tobacco use.

Methods

To estimate the percentage of office-based physician visits made by patients aged 11–21 years with documentation of screening for tobacco use, tobacco cessation counseling, and

provision of tobacco cessation medications, CDC analyzed the combined 2004–2010 data from NAMCS. NAMCS is a national probability survey of outpatient visits made to office-based physicians that measures health-care use with various health-care providers (14).

The basic sampling unit for NAMCS (and the unit of analysis) is the physician-patient encounter, or visit. The NAMCS sample included 17,066 outpatient visits among patients aged 11–21 years, ranging from 2,077 visits in 2004 to 2,702 in 2007. NAMCS estimates for tobacco use screening and tobacco cessation counseling, provision of medication during visits, or both by patients aged 11–21 years were analyzed by demographic characteristics, tobacco use status, type of health insurance, and physician- or visit-related characteristics. Patient characteristics included age, sex, race/ethnicity, and type of health insurance (private insurance, Medicare, Medicaid or State Children's Health Insurance Program [SCHIP/CHIP], no insurance [having only self-pay, no charge, or charity visits as payment sources], or other [including workers' compensation; other sources of payment not covered by private insurance, Medicare, Medicaid/SCHIP, workers' compensation, self-pay, and no charge or charity; or unknown coverage/payment]). During 2005–2010, NAMCS used a hierarchical scheme to determine the primary expected source of payment. For the 2005–2007 NAMCS, respondents who were eligible both for Medicare and Medicaid were categorized as Medicaid recipients; however, these respondents were classified as Medicare recipients in 2008–2010. To account for this change, the 2005–2007 payment type variable was recoded to be consistent with the 2008–2010 classification for primary expected source of payment. In 2004, survey respondents were only allowed to report a single expected source of payment (as primary source of payment). NAMCS data for patient visits were collected on patient record forms by the physicians and their staff members or abstracted by the U.S. Census Bureau staff members. Physician-related characteristics included whether the physician was the patient's primary care physician (determined by response to the question, "Are you the patient's primary care physician/provider?"), practice type (solo or other), specialty (primary, surgical, or medical care), and electronic medical record use in the practice.

For all survey years, nonphysician providers, federally employed physicians, and physicians in anesthesiology, pathology, and radiology specialties were excluded because they were not in the scope of the survey. In addition, hospital-based outpatient care is not included in NAMCS (unless the care occurred in a private office in a hospital that meets the NAMCS definition of a physician's office). For physicians whose major professional activity was patient care, only visits classified by the American Medical Association or the American Osteopathic

Association as office-based patient care were included. The survey methods and sampling frame have been described in the scope and documentation of the survey (14).

NAMCS defines tobacco use as documentation in the medical chart that the patient is a current user of tobacco, including cigarettes, cigars, snuff, and chewing tobacco. Tobacco use screening is defined as documentation on the patient record form of current tobacco use or no current use. Tobacco counseling is defined as information given in the form of health education to the patient on topics related to tobacco use in any form, including use of cigarettes, cigars, snuff, and chewing tobacco, or on exposure to secondhand smoke. Tobacco counseling also includes information on smoking cessation and prevention of tobacco use, as well as referrals to other health-care professionals for smoking cessation programs. Medication use includes medications that were ordered, supplied, administered, or continued during the visit. Only medications related to tobacco cessation were analyzed. These medications were entered as free text for each visit and were limited to no more than eight prescription and over-the-counter medications. Medications included nicotine replacement therapy (i.e., nicotine patch, gum, lozenge, nasal spray, and inhaler), bupropion, and varenicline.

All analyses were conducted using statistical software to account for the complex multistage sample design of NAMCS. Data from NAMCS were adjusted for nonresponse and weighted to provide national estimates of outpatient visits with tobacco screening and tobacco counseling, cessation medications, or both; 95% confidence intervals were calculated to account for the multistage probability sample design, and estimates were considered to be different if the confidence intervals did not overlap. The overlapping confidence interval approach is not a formal statistical test for assessing differences; formal statistical testing might result in different conclusions. Logistic regression analysis was used to analyze temporal changes from 2004 to 2010 in tobacco use screening, controlling for race/ethnicity, sex, and health insurance status, and simultaneously assessed linear trends by using orthogonal polynomial contrasts. For the trend analysis, statistical significance of differences was determined with significance set at $p < 0.05$. Data were not shown when the sample size was < 30 , or the relative standard error of the estimate was $> 30\%$.

Results

During 2004–2010, patients aged 11–21 years made an average of 82.6 million outpatient visits to office-based physicians annually, for an estimated total of 578 million visits during 2004–2010 combined (range: 78.7 million in

2008 to 90.6 million in 2010). Among these total 578 million outpatient visits, an average of 57.4 million (69.5%) included tobacco screening each year, for a total of 402 million visits screened for tobacco during 2004–2010 combined (71.5% in 2004, 74.0% in 2005, 70.0% in 2006, 62.4% in 2007, 67.3% in 2008, 67.3% in 2009, and 74.2% in 2010) (Table). Of the 402 million visits in 2004–2010 that included tobacco use screening, an average of 7.1% (28.7 million visits) were made by current tobacco users (8.3% in 2004, 7.2% in 2005, 7.7% in 2006, 7.4% in 2007, 6.1% in 2008, 5.0% in 2009, and 8.0% in 2010). During 2004–2010, no trend in screening for tobacco use was found among outpatient visits to office-based physicians made by patients aged 11–21 years overall or among those aged 11–17 years or those aged 18–21 years (Figure).

The proportion of visits with tobacco screening varied by age, with visits among patients aged 11–17 years more likely to include screening for tobacco use (71.5%) than visits among patients aged 18–21 years (65.7%). Screening also varied by health insurance status. Visits among patients with private insurance (71.0%) and Medicaid or SCHIP (69.6%) as the primary expected source of payment were more likely to include tobacco screening than those among patients with workers' compensation, or covered by a source other than private insurance, Medicare, Medicaid/SCHIP, workers' compensation, self-pay, and no charge or charity, or whose insurance status was unknown (59.9%). Visits to a patient's primary care physician were more likely to include tobacco screening (72.7%) than those among patients who visited a physician who was not their primary care physician (67.9%). Screening also varied by physician specialty. Visits to a pediatrician (74.7%) were more likely to include tobacco screening than those among general or family practitioners or internal medicine physicians (68.3%), psychiatrists (62.4%), and physicians in all other specialties (65.0%). Screening also varied by physician specialty group. Primary care physicians (71.2%) were more likely to screen for tobacco use during outpatient visits than physicians in medical care specialties (62.3%).

The proportion of visits made by persons who screened positive for current tobacco use varied by patient age, with a higher proportion of visits made by those aged 18–21 years (16.1%) than by those aged 11–17 years (3.0%). Physician office visits made by non-Hispanic whites (8.0%) were more likely to have documented current tobacco use than visits made by non-Hispanic blacks (4.3%), and Hispanics (4.7%). The proportion of visits that had persons with a positive screen for current tobacco use also varied by type of health insurance, with visits made by those with Medicaid/SCHIP coverage (9.5%) and those who had no insurance (16.8%) more likely to be current tobacco users than those with private insurance (5.3%). In addition, the proportion of visits by persons who

TABLE. Percentage of outpatient visits to office-based physicians by patients aged 11–21 years that included tobacco use screening, counseling, and cessation assistance, by patient and physician characteristics — National Ambulatory Medical Care Survey, United States, 2004–2010

Characteristic	Tobacco screening* during visit (n = 11,562) [†]		Visits by current tobacco users [§] (n = 987)		Visits by current tobacco users with tobacco counseling, [¶] cessation medication, ^{**} or both (n = 214)	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Age group (yrs)						
11–17	71.5	(69.8–73.2)	3.0	(2.4–3.5)	21.8	(15.2–28.3)
18–21	65.7	(63.4–67.9)	16.1	(14.3–17.9)	19.1	(14.9–23.2)
Sex						
Male	69.4	(67.4–71.4)	6.2	(5.3–7.0)	20.9	(15.7–26.2)
Female	69.6	(67.9–71.3)	7.9	(6.9–8.8)	19.2	(15.0–23.4)
Race/Ethnicity						
White, non-Hispanic	70.0	(68.3–71.7)	8.0	(7.1–8.9)	19.3	(15.6–23.0)
Black, non-Hispanic	68.0	(64.6–71.3)	4.3	(3.0–5.7)	— ^{††}	—
Hispanic	68.2	(64.9–71.4)	4.7	(3.2–6.1)	—	—
Other race/multiple race, non-Hispanic	69.9	(65.4–74.3)	7.5	(4.5–10.5)	—	—
Health insurance						
Private insurance	71.0	(69.2–72.7)	5.3	(4.5–6.2)	21.9	(16.6–27.1)
Medicare	64.4	(54.8–73.9)	—	—	—	—
Medicaid/SCHIP	69.6	(66.7–72.5)	9.5	(7.5–11.5)	17.9	(12.7–23.2)
No insurance ^{§§}	66.3	(61.6–71.0)	16.8	(13.4–20.1)	22.6	(11.8–33.5)
Other ^{¶¶}	59.9	(55.0–64.7)	12.2	(8.7–15.8)	—	—
Patient's primary care physician						
Yes	72.7	(70.8–74.6)	5.3	(4.4–6.2)	26.3	(20.3–32.3)
No	67.9	(65.6–70.1)	9.4	(8.1–10.7)	16.6	(12.3–20.9)
Solo practice^{***}						
Yes	69.5	(66.8–72.1)	7.1	(5.6–8.6)	18.1	(11.8–24.4)
No	69.6	(67.7–71.5)	7.2	(6.2–8.1)	20.6	(16.7–24.6)
Physician specialty						
General/Family practice and internal medicine	68.3	(65.3–71.3)	10.3	(8.6–12.0)	21.2	(15.2–27.1)
Pediatrics	74.7	(71.6–77.7)	1.9	(1.3–2.5)	32.7	(19.9–45.5)
Obstetrics and gynecology	70.4	(66.0–74.7)	14.2	(11.3–17.2)	20.2	(12.8–27.6)
Psychiatry	62.4	(56.5–68.3)	12.4	(9.7–15.0)	27.4	(16.6–38.3)
All other specialties	65.0	(61.8–68.1)	6.8	(5.7–7.9)	—	—
Physician specialty group^{†††}						
Primary care	71.2	(69.1–73.2)	6.9	(5.9–7.8)	23.0	(18.3–27.7)
Surgical care	66.5	(62.3–70.6)	7.2	(5.5–8.9)	—	—
Medical care	62.3	(58.2–66.4)	7.1	(5.4–8.9)	20.6	(12.6–28.6)

See table footnotes on page 75.

screened positive for current tobacco use was lower when the visit was with the primary care physician (5.3%) than when the visit was with a physician who was not a primary care physician (9.4%). Current tobacco use was less likely to be found during visits to pediatricians (1.9%) than visits to physicians with other specialties (general or family practice or internal medicine, 10.3%; obstetrics and gynecology, 14.2%; psychiatry, 12.4%; and all other specialties, 6.8%).

Among visits made by persons identified as current tobacco users, 19.8% received any cessation assistance, including tobacco counseling in the form of health education ordered or provided at the visit, a prescription or order for a cessation medication, or both during their visit. Cessation assistance (including counseling, medication, or both) was more likely to be delivered during visits in which preventive care was the

major reason for the visit (28.9%) than during visits for other reasons (16.7%).

Discussion

The findings in this report indicate that tobacco use screening occurred during the majority (69.5%) of visits to outpatient physician offices by patients aged 11–21 years during 2004–2010. However, during visits by current tobacco users, only 19.8% received any cessation assistance, including counseling, medications, or both. This finding is consistent with a recent literature review that found that low adherence by health-care providers to recommended screening and prevention interventions for children and adolescents (2). The

TABLE. (Continued) Percentage of outpatient visits to office-based physicians by patients aged 11–21 years that included tobacco use screening, counseling, and cessation assistance, by patient and physician characteristics — National Ambulatory Medical Care Survey, United States, 2004–2010

Characteristic	Tobacco screening* during visit (n = 11,562) [†]		Visits by current tobacco users [§] (n = 987)		Visits by current tobacco users with tobacco counseling, [¶] cessation medication, ^{**} or both (n = 214)	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Time spent with physician (minutes)						
<20	69.0	(67.1–70.8)	6.7	(5.7–7.6)	16.8	(12.3–21.4)
≥20	70.5	(68.4–72.5)	7.9	(6.9–8.9)	24.0	(19.1–28.8)
Preventive care^{§§§}						
Yes	71.3	(68.9–73.7)	7.0	(5.7–8.3)	28.9	(21.5–36.3)
No	69.4	(67.6–71.1)	7.2	(6.3–8.0)	16.7	(13.1–20.3)
Practice uses electronic medical records^{¶¶¶}						
Yes	70.6	(68.1–73.0)	7.3	(6.0–8.7)	20.7	(14.3–27.0)
No	68.9	(66.8–70.9)	7.0	(6.2–7.9)	19.3	(15.1–23.4)
Total (n = 17,066)^{****}	69.5	(68.0–71.1)	7.1	(6.4–7.9)	19.8	(16.4–23.3)

Abbreviations: CI = confidence interval; SCHIP = State Children's Health Insurance Program.

* Visits during which information about tobacco use was documented (either current tobacco use [currently smoke cigarettes or cigars or use snuff or chewing tobacco] or no current use). Denominator includes current tobacco use, no current use, unknown, and blanks.

[†] Yearly visits with tobacco screening: 1,411 in 2004; 1,530 in 2005; 1,719 in 2006; 1,702 in 2007; 1,605 in 2008; 1,716 in 2009; and 1,879 in 2010.

[§] Visits during which current tobacco use (smoking cigarettes or cigars or using snuff or chewing tobacco) was documented.

[¶] Tobacco counseling refers to any information provided that related to tobacco use in any form, including cigarettes, cigars, snuff, and chewing tobacco, and on exposure to tobacco in the form of secondhand smoke, smoking cessation, and prevention of tobacco use, as well as referrals to other health-care providers for smoking cessation programs.

^{**} Cessation medications include nicotine replacement therapy (nicotine patch, gum, lozenge, nasal spray, and inhaler), bupropion, and varenicline.

^{††} Data not shown because sample size is <30, or the relative standard error of the estimate is >30%.

^{§§} No insurance is defined as having only self-pay, no charge, or charity visits as payment sources.

^{¶¶} Includes workers' compensation; other sources of payment not covered by private insurance, Medicare, Medicaid/SCHIP, workers' compensation, self-pay, and no charge or charity; or unknown.

^{***} Medical practice run by an individual physician; a solo practitioner offering medical services on a person-to-person basis (i.e., not a group practice).

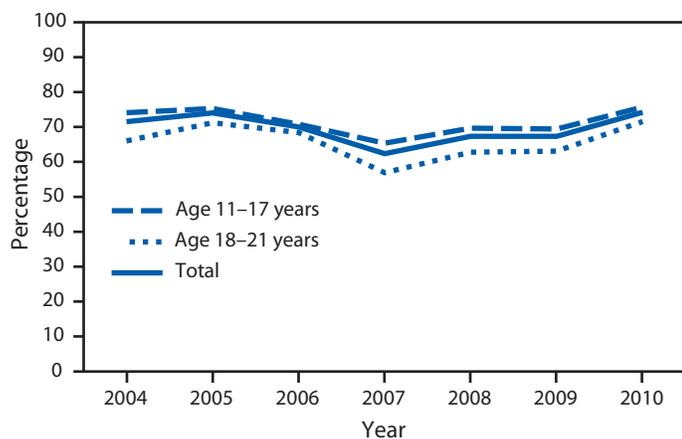
^{†††} The American Medical Association's physician specialties were further regrouped into primary care, surgical, and medical specialties for analytic purposes. Primary care specialty includes adolescent medicine, family practice, general practice, internal medicine, obstetrics and gynecology, pediatrics, psychiatry, and other specialties related to primary care. Surgical care specialty includes all surgical specialties, including orthopedics, ophthalmology, and otolaryngology. Medical care specialty includes specialist physicians such as allergists, cardiologists, dermatologists, endocrinologists, pulmonologists, gastroenterologists, nephrologists, and neurologists. Additional information is available at [ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NAMCS](http://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NAMCS).

^{§§§} Includes routine prenatal, well-baby, screening, insurance, and general examinations.

^{¶¶¶} Practice uses electronic medical records or health records (not including billing records).

^{****} Yearly total visits: 2,077 in 2004; 2,145 in 2005; 2,538 in 2006; 2,702 in 2007; 2,442 in 2008; 2,535 in 2009; and 2,627 in 2010.

FIGURE. Percentage of office-based physician outpatient visits by patients aged 11–21 years that included tobacco use screening, by age group — National Ambulatory Medical Care Survey, United States, 2004–2010



PHS guideline concluded that clinicians should ask children and adolescents about their tobacco use, provide a strong prevention message, and provide adolescent smokers with counseling to help them quit (4). The *Healthy People 2020* objectives include increasing quit attempts among adolescent smokers (objective TU-7) and health systems changes for increasing both tobacco use screening and cessation counseling among tobacco users aged ≥18 years in office-based ambulatory care settings (objectives TU-9.1 and TU-10.1). Both primary[¶] and secondary^{**} prevention through clinical preventive services are needed to address tobacco use early in the lifespan to prevent tobacco-related morbidity and mortality (2,4).

[¶] Primary prevention methods are used before a person gets a disease. The goal of primary prevention is to prevent the disease from occurring.

^{**} Secondary prevention is used after a disease has developed but before the person notices that anything is wrong. The goal of secondary prevention is to diagnose and treat the disease early.

Preventing initiation of tobacco use or progression from experimentation to established use among adolescents and young adults is critical because among adults who become daily smokers, 88% first use cigarettes by the age of 18 years, with 99% first using cigarettes by the age of 26 years (2). Providers have a clear opportunity to intervene with this population because 84.2% of adolescents (aged 10–17 years) in 2006 had visited a doctor's office in the past year (2,6). During 2004–2010, patients aged 11–21 years who were insured by private insurance or Medicaid/SCHIP were more likely to receive tobacco screening than were patients with other sources of coverage. In addition, patients who were insured by Medicaid/SCHIP or those who had no insurance were more likely to be current tobacco users than those with private insurance. Insurance coverage (compared with no insurance coverage) for tobacco dependence treatments (including both counseling and medication) increases the proportion of smokers who attempt to quit, use cessation treatment, and successfully quit (4). However, neither private insurers nor state traditional Medicaid programs consistently provide comprehensive coverage for evidence-based cessation treatments, including counseling, medications, and referrals to quitlines (4). For example, in 2014, although all 51 Medicaid programs covered some form of tobacco-dependence treatment for some Medicaid enrollees, only seven states covered all seven cessation medications approved by the Food and Drug Administration and individual and group counseling for all Medicaid enrollees (15). A *Healthy People 2020* objective (TU-8) is to expand comprehensive Medicaid insurance coverage of evidence-based cessation treatments to all 50 states and the District of Columbia (8).

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (16). Among other relevant provisions (17), some provisions of the law might be particularly relevant for adolescents. As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of the U.S. Preventive Services Task Force (USPSTF) graded A (strongly recommended) or B (recommended) (18); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (19); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by the Health Resources and Services Administration (HRSA) and AAP (20) and those developed by

the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (21); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (22). USPSTF recommends that primary care clinicians provide interventions, including education or brief counseling, to prevent initiation of tobacco use in school-aged children and adolescents. This is a USPSTF Grade B recommendation, which indicates that there is moderate certainty that the interventions have a moderate net benefit (23). As of October 1, 2010, ACA § 4107 requires state traditional Medicaid programs to provide tobacco cessation counseling and pharmacotherapy to pregnant women with no cost-sharing. In addition to this benefit requirement for pregnant women, states are required to cover tobacco cessation services for children when medically necessary and may rely on optional Medicaid benefit categories to provide coverage of tobacco cessation services to other Medicaid beneficiaries. The coverage of medically necessary tobacco cessation services, including both counseling and pharmacotherapy, for children and adolescents, is mandatory under the Early and Periodic Screening, Diagnostic, and Treatment benefit. This benefit includes the provision of anticipatory guidance and risk-reduction counseling with regard to tobacco use during routine well-child visits. In addition to routine visits, additional counseling and tobacco cessation drug therapy must be provided when medically necessary for persons aged <21 years (24). Effective January 1, 2014, ACA also prohibited state Medicaid programs from excluding FDA-approved cessation medications, including over-the-counter medications, from Medicaid drug coverage (ACA § 2502) (25). The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.^{††} Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Newly qualified health insurance plans operating in the Marketplace are required to offer their members cessation coverage without cost-sharing (25,26).

In addition to the USPSTF tobacco use intervention recommendations for children and adolescents, several national guidelines by medical societies and organizations were used to develop recommendations that physicians should routinely provide tobacco screening, education, and counseling to children and adolescents (2). In addition, employers, health

^{††} The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

plans, health-care professionals, and voluntary associations also can take steps to increase use of clinical preventive services and implementation of proven community preventive interventions by supporting policy and environmental change interventions that help to prevent youths from starting to smoke and to help adult smokers quit. These interventions include ensuring comprehensive coverage of cessation treatments, implementing provider reminder systems in health-care settings, establishing smoke-free policies, increasing the price of tobacco products, and educating the public through mass media campaigns (2,5,12).

Several barriers can impede clinician assessment and treatment of smokers, including lack of knowledge of effective intervention strategies, lack of time, inadequate payment for treatment, and lack of institutional support for routine assessment and treatment of tobacco use (4). Specifically regarding delivery of clinical preventive services to youths, physicians cite similar and additional barriers, including 1) large patient caseloads, resulting in limited time per patient; 2) competing health-care demands during preventive visits; 3) inadequate training; 4) lack of information on how to access referral and treatment resources; 5) lack of dissemination of research to physicians that supports positive treatment outcomes and negative effects from failing to intervene; 6) fear of alienating patients and their families; and 7) inadequate reimbursement (2). The findings in this report indicate that both physician and visit characteristics were related to the likelihood of screening and counseling for tobacco use occurring during a visit. Visits made to primary care physicians had a higher likelihood of screening for tobacco use than visits to physicians who were not primary care physicians. Among adolescents, visits made by non-Hispanic whites were more likely to be current tobacco users than visits by non-Hispanic blacks or Hispanics. Additional studies are needed to examine the disparity in current tobacco use status. Visits made to pediatricians were less likely to have current tobacco use status than visits to physicians with other specialties. Perhaps the older adolescents who were current smokers did not visit pediatricians any more, although pediatricians were more likely to conduct tobacco screening than other practitioners (e.g., general or family practice, internal medicine, or psychiatry). Previous studies have suggested that female providers, physicians aged <50 years, recent medical school graduates, and pediatricians were more likely to engage in certain specific types of preventive interventions and counseling with adolescents and their parents (2).

Cessation assistance was delivered more frequently during outpatient visits for which the major reason for the visit was preventive care. Health-care systems can support physician

interventions by instituting effective systems-level changes that make screening for tobacco use and brief cessation interventions for tobacco users a standard part of every office visit. Provider reminder systems increase health-care providers' assessment and treatment of tobacco use in a range of clinical settings and populations (12). Provider reminder systems prompt providers to screen and treat patients for tobacco use and can be implemented as chart stickers, vital sign stamps, medical record flow sheets, checklists, or part of electronic medical records. A recent literature review concluded that provider reminder systems, and provider trainings, are promising approaches for increasing delivery of tobacco preventive services to children and adolescents (2).

Tobacco dependence costs the United States approximately \$96 billion per year in direct medical expenses and \$97 billion in lost productivity (5). Tobacco use treatments, ranging from clinician advice to medication to specialist-delivered intensive programs, not only are clinically effective but also are more cost-effective than other medical interventions (4,27–29). In a study on the priorities among effective clinical preventive services, tobacco-use screening and brief intervention among adults was one of the three highest ranking clinical preventive services (each with a total cost-effectiveness score of 10), equal in rank to discussing aspirin use with adults at high risk for cardiovascular events and to vaccinating children (28). Evidence-based tobacco dependence interventions yield a favorable return on investment from the perspective of both the employer and health plan because of reduced use of health-care services and lower related costs (30–32).

As part of its National Tobacco Control Program, CDC recommends that states implement population-based strategies and environmental interventions that reduce tobacco use, including working with health-care systems, insurers, and purchasers of health insurance to expand coverage for tobacco cessation treatments and to implement health systems changes that integrate cessation clinical interventions into routine care (5,12). CDC and states also support other effective interventions for increasing cessation including increasing the unit price of tobacco products, conducting emotionally evocative anti-tobacco mass media campaigns such as the recent CDC Tips from Former Smokers campaign, providing telephone cessation counseling, and making workplaces and public places smoke-free (5,12). Public health programs should implement a comprehensive approach to tobacco cessation by using population-based strategies, including media interventions, to motivate tobacco users to quit while simultaneously making evidence-based cessation treatments readily available to tobacco users who want help to quit (5,12,33).

Limitations

The findings in this report are subject to at least seven limitations. First, the definition of tobacco counseling included any information on tobacco use or secondhand smoke exposure, as well as referrals to tobacco cessation programs. Therefore, the type of information provided could not be assessed, and subsequently the use of the 5 A's for smoking cessation intervention could not be tracked (Health-care providers 1] ask about tobacco use, 2] advise tobacco users to quit, 3] assess willingness to make a quit attempt, 4] assist in a quit attempt, and 5] arrange for follow-up [4]). Second, because there were not enough data to stratify results by age (<18 years versus ≥18 years), it is likely that these age groups see different providers and receive different types of tobacco-related information and cessation treatments (i.e., medication only for those aged ≥18 years). Third, bupropion can be prescribed both as an antidepressant and for tobacco cessation, and the medical indication could not be determined from the data collected. Fourth, quality and completeness of reporting, including documentation in the medical record, might have varied over time, and year-to-year differences in tobacco use screening rates might have been due, in part, to differences in the quality of reporting. This might have resulted in an underestimation or overestimation of the proportion of screening for tobacco use and cessation counseling. Additional research is needed to understand differences in reporting over time. Fifth, because information on tobacco counseling was available only for the current visit, whether health education also occurred at previous visits is unknown. Sixth, because analysis is based on visits, if a patient had multiple visits to the sampled physician during the reporting period (1 week) and only certain visits during that reporting period had tobacco use screening, by randomly choosing the visits for the patient, some visits with tobacco use screening might have been missed. Finally, NAMCS data that are obtained through self-reporting by physicians or their staff members include no record validation.

Conclusion

Tobacco use screening and intervention is one of the most cost-effective clinical preventive services (4,23,24) and is an important component of a comprehensive strategy for increasing tobacco use cessation and reducing tobacco use. However, during 2004–2010, screening for tobacco use among patients aged 11–21 years did not increase, and among current tobacco users, only 19.8% received any cessation assistance. Treating tobacco dependence can prevent the development of various costly chronic diseases, including heart disease,

cancer, and pulmonary disease, resulting in major health improvements and cost savings (4). Assessing tobacco use among adolescents and providing cessation counseling are essential (2,4). Results from this report can be used by researchers and health-care providers to track and improve adherence to the PHS guideline and to identify opportunities for other programs to reach youths and young adults, as well as to identify population-based strategies to reduce tobacco initiation and increase tobacco cessation, such as increasing the price of tobacco products, prohibiting smoking in workplaces and public places, and expanding health insurance coverage of cessation treatments.

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Chlamydia Screening Among Females Aged 15–21 Years — Multiple Data Sources, United States, 1999–2010

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Introduction

Chlamydia is a sexually transmitted infection caused by the bacterium *Chlamydia trachomatis*. Chlamydia is the most commonly reported notifiable disease in the United States, with 1.4 million cases reported in 2012 (1). Chlamydia is usually asymptomatic in both men and women, and as a result, infections often are undiagnosed. Approximately 3 million new infections are estimated to occur each year (1). Among sexually active females aged 14–19 years, chlamydia prevalence has been estimated to be 6.8% (2). In a recent study involving approximately 1 million tests conducted among both privately insured and Medicaid-insured females aged 15–21 years, chlamydia positivity ranged from 6.9% to 10.7% among those with chlamydial symptoms and from 6.1% to 9.6% among those who were asymptomatic (3).

Chlamydial infection in females causes cervicitis, which is usually asymptomatic; however, infection sometimes can cause such symptoms as abnormal vaginal discharge, intermenstrual bleeding, dyspareunia, dysuria, or pelvic pain (4). If chlamydial cervicitis is untreated, infection can ascend to the upper genital tract along with other microorganisms that are part of the vaginal microflora (e.g., anaerobic bacteria) to cause pelvic inflammatory disease (PID) (5,6). The inflammatory and immune responses induced during PID can cause fallopian tube damage, scarring, and blockage (7), which can result in long-term adverse outcomes of tubal factor infertility, ectopic pregnancy, and chronic pelvic pain (8). Some females who have uncomplicated cervicitis have concurrent subclinical PID at the time that chlamydial cervicitis is diagnosed (9), and subclinical PID also has been associated with infertility (10). Screening for and treating chlamydial infection decreases incidence of PID (11,12). Screening for chlamydia also identifies persons at increased risk for HIV infection. Chlamydial infection has been linked to HIV transmission (13,14) because of similar sexual risk behaviors and possible increased biologic susceptibility

caused by breaches in the mucosa and inflammation from the infection. Chlamydial infection is diagnosed easily by using vaginal or endocervical swab specimens or urine samples that are tested with nucleic acid amplification tests (NAATs), and treatment with oral antibiotics is simple, safe, and effective (4).

Routine annual chlamydia screening of sexually active young women is one of several important preventive reproductive health-care services. The U.S. Preventive Services Task Force (USPSTF) recommends annual chlamydia screening of all sexually active nonpregnant females aged ≤ 24 years. This is a USPSTF Grade A recommendation, which means that USPSTF strongly recommends the service. The certainty is high that the benefits of screening for chlamydial infection substantially outweigh the harms. USPSTF concluded that the harms of screening for chlamydia infection are no greater than small, although few studies have been published on this subject (15). USPSTF also recommends screening of pregnant females aged ≤ 24 years. This is a USPSTF Grade B recommendation, which means that USPSTF recommends the service. The certainty is moderate that the benefits substantially outweigh the harms of screening for chlamydia infection (15). *Healthy People 2020* objectives include increasing the proportion of sexually active females aged 16–24 years who are screened each year for genital chlamydial infection (objectives STD-3 and STD-4) (16). The National Quality Forum (NQF) has endorsed as a performance measure the percentage of sexually active females aged 16–24 years who had at least one test for chlamydia in a year (NQF #0033) (17).

Public health has an essential role in monitoring adherence to recommendations for chlamydia screening and in working with the health-care sector and other stakeholders to develop and implement interventions to increase screening. Monitoring screening coverage of young women has been challenging. Screening refers to testing of asymptomatic persons, but no single available data source provides a valid, accurate, and reliable estimate of chlamydia screening coverage in sexually

active asymptomatic young women. Because chlamydial infections usually are asymptomatic, chlamydia testing rates have been used to estimate screening rates.

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (18). This report analyzes 1999–2010 data from multiple data sources to estimate the prevalence of chlamydia screening among U.S. females aged 15–21 years. Public health authorities and clinicians can use these data to identify population subgroups that might require additional strategies to increase access and utilization of chlamydia screening.

Methods

Multiple data sources can be used to assess chlamydia testing coverage and provide insight into chlamydia screening patterns. The National Survey of Family Growth (NSFG) and the National Ambulatory Medical Care Survey (NAMCS) can be used to estimate population-based testing coverage of adolescent females and their use of chlamydia testing at visits to physician offices. NSFG provides estimates of self-reported testing and uses the ideal denominator of an estimate of all U.S. females who reported sexual activity. NAMCS provides insight into use patterns of this reproductive health service among females who have access to health care and identifies missed opportunities for screening of U.S. females who had clinical encounters. Healthcare Effectiveness Data and Information Set (HEDIS) measures of chlamydia testing of women enrolled in commercial and Medicaid health plans, and Title X-funded family planning clinic testing data can be used to monitor temporal trends in chlamydia screening.

To estimate chlamydia screening rates of U.S. adolescent females, CDC used four data sources: the 2006–2010 NSFG, the 2005–2010 NAMCS, 1999–2010 HEDIS measure data, and 2005–2010 Title X data. The age range of 15–21 years was used for analyses with NSFG and NAMCS data; HEDIS data were available only for females aged 16–20 years and Title X data only for those aged 15–19 years.

To estimate the percentage of sexually active females aged 15–21 years who reported that they had been tested for

chlamydia in the past 12 months, CDC analyzed 2006–2010 NSFG data. NSFG is a multistage national probability sample of the U.S. population aged 15–44 years residing in households (19). During 2006–2010, a total of 12,279 females were interviewed, and the response rate was 78% (20). The survey methods were similar to those described previously (21). Analyses were limited to the 1,811 sexually active females aged 15–21 years who reported that they had been tested for chlamydia in the past 12 months. Being sexually active was defined as reporting having had one or more male sex partners in the past 12 months; and having sex included having vaginal intercourse, oral sex, or anal sex. The frequency of chlamydia testing was estimated by the females' demographic characteristics, self-reported number of sexual partners in the past 12 months, and self-reported receipt of reproductive health-care services in the past 12 months. Data were weighted to provide nationally representative estimates, and analytic methods were used to account for the complex sampling procedure used by NSFG. Differences between percentages of females were compared by using the Chi-square test; a two-sided p -value <0.05 was considered statistically significant.

To estimate the mean annual percentage of nonpregnant females aged 15–21 years who were tested for chlamydia at visits to primary care physician offices, CDC analyzed NAMCS data from 2005–2010. Primary care specialties included general and family practice, internal medicine, pediatrics, and obstetrics and gynecology. NAMCS is a multistage national probability sample of visits to nonfederally employed U.S. physician offices, including private practices and other freestanding clinics (e.g., urgent care centers, public health clinics, family planning clinics, mental health centers, community health centers, and faculty practice plans) (22). The unit of analysis used was a patient visit, with extraction of data from a review of the patient's medical record. In 2007, medical records from 32,778 patient visits to 1,568 physicians were reviewed, with a response rate of 61% (22). Survey methods used were similar to those described previously (23–25); CDC estimated the frequency of chlamydia testing at visits made by nonpregnant females aged 15–21 years by their demographic characteristics, primary care provider specialty, diagnosis at visit, and receipt of reproductive health-care service. Data were weighted to provide nationally representative estimates, and analytic methods were used to account for the complex sampling procedures used by NAMCS. Differences between percentages of visits were compared by using the Chi-square test; a two-sided p -value <0.05 was considered statistically significant.

Since 1999, the National Committee for Quality Assurance (NCQA) has collected health-care claims data for HEDIS measures of annual chlamydia screening among young females. NCQA is a private nonprofit organization that monitors the quality of U.S. health plans using data that are submitted

voluntarily to HEDIS annually. HEDIS is used by 90% of U.S. health plans to evaluate the quality of health-care services and to benchmark performance (26). To estimate the annual percentage of chlamydia screening among sexually active females aged 16–20 years enrolled in commercial and Medicaid health-care plans during 1999–2010, CDC used administrative data with *International Classification of Diseases 9th Edition* and Current Procedural Terminology (CPT) billing codes. Methods used were similar to those described previously (26). Sexually active females were defined as those who had health-care encounters for a gynecologic examination, pregnancy, contraception, sexually transmitted disease (STD) services, cervical cancer screening, or infertility evaluation or treatment. Among females who had one of these encounters, a chlamydia test was identified by using CPT codes for chlamydia testing at the health-care encounter.

Title X is a federal program administered by the U.S. Department of Health and Human Services' Office of Population Affairs (OPA). Title X provides family planning and related preventive health-care services, with priority given to low-income persons; services include chlamydia testing. Since 2005, the program has monitored chlamydia testing, with service grantees reporting testing data to OPA annually (27,28). For purposes of this analysis, family planning clinic users were assumed to be sexually active and therefore should have been screened according to recommendations. For each year during 2005–2010, the percentage of users who were tested for chlamydia was calculated as the number of unduplicated female users aged 15–19 years who were tested among all family planning users in this age group.

Results

On the basis of NSFG data, a weighted estimate of 8.2 million (56.6%) U.S. females aged 15–21 years reported that they were sexually active, of whom 3.30 million (40.0%) reported that they had been tested for chlamydia in the past 12 months (Table). A chlamydia test was reported by a significantly larger proportion of sexually active women aged 20–21 years (50.0%) than by adolescents aged 18–19 years (38.2%) or those aged 15–17 years (25.2%) ($p<0.001$). Non-Hispanic black adolescent females had the highest testing rates (56.1%) compared with members of other racial and ethnic groups ($p<0.001$). Females who had Medicaid insurance or were uninsured had higher testing rates (48.4% and 43.8%, respectively) than those who had private insurance (33.8%) ($p<0.001$). Females with an income-to-poverty ratio of $\leq 138\%$ had higher testing rates (42.7%) than those with a ratio of $>138\%$ (38.0) ($p<0.05$). Females who had two or more sexual

partners had higher testing rates (45.8%) than those who had only one partner (36.3%) ($p<0.001$). A larger proportion of sexually active females who had received other reproductive health services (e.g., family planning or contraception, a pregnancy test, pelvic examination, or a Papanicolaou test) in the past 12 months reported having had a chlamydia test compared with females who did not receive these services.

On the basis of NAMCS data, among a weighted estimate of 20.9 million visits to primary care physician offices made by females aged 15–21 years, a chlamydia test was performed at only 4.3% of visits (Table). Testing was performed more often at visits to obstetrics and gynecology offices (11.1%) than at visits to other primary care specialties (2.3%; $p<0.001$). A chlamydia test was very rare at visits to pediatricians, with no chlamydia test performed at most visits (99.1% [standard error: 0.48]). Females who made visits with symptoms or signs of chlamydial infection were tested at 9.9% of these visits, but only at 3.2% of visits for other reasons ($p<0.001$). Screening was performed at 8.4% of visits for preventive care compared with other visits (2.5%; $p<0.001$) and more frequently at visits for reproductive health services than at visits for other services. A chlamydia test was performed at 28.1% of visits with a Pap test compared with 1.7% of visits without Pap testing ($p<0.001$).

During 1999–2010, the HEDIS measure of chlamydia testing of commercially insured females aged 16–20 years increased from 18.5% to 40.8% (Figure). During 2001–2010, the HEDIS measure of chlamydia testing of Medicaid-insured females aged 16–21 years increased from 39.6% to 54.6%. During 2005–2010, Title X service providers tested 3.4 million female family planning users aged 15–19 years for chlamydia, and the percentage of females tested for chlamydia increased from 49.8% in 2005 to 56.7% in 2010 (Figure). Over all years, the annual rates of chlamydia testing of Medicaid-insured females and Title X female family planning clinic users were both higher compared with rates of commercially insured females.

Discussion

In this report, nationally representative rates of chlamydia screening of U.S. adolescent females were estimated by using NSFG data to generate self-reported testing rates and by using NAMCS data to generate testing rates at visits on the basis of medical record review. HEDIS measure data and Title X data were used to estimate temporal trends in the annual chlamydia testing rate. Although the methods, age groups, and units of measure varied, all the findings support the conclusion that many sexually active adolescent females in the United States were

TABLE. Rate of self-reported chlamydia testing in the past 12 months among sexually active females aged 15–21 years and mean annual rate of chlamydia testing at physician office visits of nonpregnant females aged 15–21 years — National Survey of Family Growth, United States, 2006–2010 and National Ambulatory Medical Care Survey, United States, 2005–2010

Characteristic	Sexually active females* [†] (NSFG)			Physician office visits [†] (NAMCS)		
	No.	% that reported a chlamydia test (SE)	p value	No.	Percentage with a chlamydia test (SE)	p value
Age group (yrs)						
15–17	1,935,392	25.2 (2.6)	<0.001	9,881,840	3.19 (0.68)	0.07
18–19	2,962,664	38.2 (2.8)		5,454,810	4.62 (0.85)	
20–21	3,344,037	50.0 (2.6)		5,600,650	5.98 (0.95)	
Race/Ethnicity						
White, non-Hispanic	4,845,970	38.1 (2.0)	<0.001	14,160,830	3.88 (0.53)	0.84
Black, non-Hispanic	1,377,930	56.1 (3.5)		3,047,640	5.80 (1.09)	
Hispanic [§]	1,457,890	36.6 (4.0)		2,845,830	4.93 (1.25)	
Other non-Hispanic [¶]	560,300	25.0 (5.8)		882,990	4.02 (2.37)**	
Region^{††}						
Northeast	1,246,370	44.1 (4.3)	0.41	4,431,530	3.31 (0.77)	0.42
Midwest	2,324,620	37.8 (2.5)		4,454,540	3.74 (0.76)	
South	2,768,010	42.3 (2.9)		8,102,340	4.78 (0.82)	
West	1,903,100	36.5 (4.0)		3,948,880	5.10 (1.08)	
Insurance						
Private insurance	4,365,890	33.8 (2.3)	<0.001	13,351,850	4.21 (0.61)	0.40
Medicaid or SCHIP	2,082,440	48.4 (3.1)		4,750,270	3.72 (0.84)	
Uninsured	828,010	43.8 (4.2)		1,198,010	4.12 (2.04)**	
Other ^{§§}	320,580	51.5 (8.1)**		1,637,160	7.00 (1.64)**	
Income-to-poverty ratio (%)						
≤138	3,500,467	42.7 (2.7)	<0.05	NA	NA	
>138	4,741,626	38.0 (2.4)		NA	NA	
Poverty in patient zip code (%)						
<10	NA	NA		7,408,520	3.46 (0.61)	0.10
≥10	NA	NA		13,528,770	4.77 (0.57)	
No. of male sex partners						
1	5,060,390	36.3 (2.1)	<0.01	NA	NA	
≥2	3,181,700	45.8 (2.7)		NA	NA	
Community health center visit^{¶¶}						
Yes	NA	NA		999,970	5.54 (1.41)	0.35
No	NA	NA		20,526,940	4.15 (0.48)	
Physician specialty						
Obstetrics and gynecology	NA	NA		4,756,350	11.14 (1.24)	<0.001
Other ^{***}	NA	NA		16,180,950	2.30 (0.44)	
Preventive care						
Yes	NA	NA		6,481,820	8.43 (1.09)	<0.001
No	NA	NA		14,455,480	2.46 (0.44)	

See table footnotes on page 84.

not tested as recommended, even when they visited a physician with symptoms and signs consistent with chlamydial infection.

Chlamydia testing rates were lowest at visits to pediatricians, who conduct 48% of all health-care visits for adolescents aged 15–16 years and 23% of all visits for those aged 17–18 years (29), two age groups with high rates of infection (1–3). Many screening opportunities at clinical visits were missed for young females, including at preventive visits. Preventive visits are an ideal opportunity to discuss sexual and reproductive health issues, including STD and pregnancy prevention, and to perform chlamydia screening (30,31). Testing rates were higher among females who used reproductive health services, both by self-report in NSFG and by medical record review in

NAMCS. However, even at visits for reproductive health care, testing was suboptimal, and many opportunities were missed. Testing coverage has not increased to a sufficient extent over the 12-year period that HEDIS data have been monitored. Although testing rates were higher for Medicaid-insured females and Title X family planning clinic users compared with commercially insured females, testing rates in all these groups were suboptimal. Chlamydia screening of young females has been demonstrated to be cost-effective compared with other common clinical preventive services (32). Nevertheless, it is relatively underutilized compared with other preventive services recommended by USPSTF (32).

TABLE. (Continued) Rate of self-reported chlamydia testing in the past 12 months among sexually active females aged 15–21 years and mean annual rate of chlamydia testing at physician office visits of nonpregnant females aged 15–21 years — National Survey of Family Growth, United States, 2006–2010 and National Ambulatory Medical Care Survey, United States, 2005–2010

Characteristic	Sexually active females* [†] (NSFG)			Physician office visits [†] (NAMCS)		
	No.	% that reported a chlamydia test (SE)	p value	No.	Percentage with a chlamydia test (SE)	p value
Symptomatic^{†††}						
Yes	NA	NA		3,566,590	9.86 (1.67)	<0.001
No	NA	NA		17,370,710	3.17 (0.44)	
Family planning/contraception^{§§§}						
Yes	5,223,784	47.9 (2.1)	<0.001	1,828,590	14.81 (2.35)	<0.001
No	3,018,309	26.2 (2.4)		19,108,700	3.31 (0.41)	
Pregnancy test^{¶¶¶}						
Yes	2,845,130	61.2 (2.5)	<0.001	1,087,980	19.87 (4.46)**	<0.001
No	4,656,040	32.5 (2.0)		20,568,100	3.75 (0.47)	
Urine test						
Yes	NA	NA		2,751,180	11.39 (2.05)	<0.001
No	NA	NA		18,186,120	3.24 (0.39)	
Pelvic exam						
Yes	3,983,180	61.1 (2.1)	<0.001	3,773,780	17.73 (1.96)	<0.001
No	4,258,910	20.1 (2.0)		17,163,510	1.36 (0.35)	
Pap test						
Yes	4,955,090	57.2 (2.0)	<0.001	2,041,230	28.08 (3.25)	<0.001
No	3,287,000	14.0 (1.7)		18,896,070	1.74 (0.34)	
Total	8,242,090****	40.0 (1.7)		20,937,300****	4.31 (0.44)	

Abbreviations: NA = not available; NAMCS = National Ambulatory Medical Care Survey; NSFG = National Survey of Family Growth; SCHIP = State Children's Health Insurance Program; SE = standard error.

* Females aged 15–21 years who reported having any type of sex with one or more male partners in the past 12 months.

[†] By nonpregnant U.S. females aged 15–21 years; estimates weighted for the probability of selection, nonresponse rate, and population ratio.

[§] Persons of Hispanic ethnicity can be of any race or combination of races.

[¶] Includes Asian, Hawaiian/Pacific Islander, American Indian/Alaska Native, and multiple races.

** Estimate might be unstable because it is based on <100 respondents (NSFG) or <30 visits (NAMCS).

^{††} *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia, and *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

^{§§} Includes Medicare, Worker's Compensation, self-pay, no charge/charity, and other.

^{¶¶} NAMCS data available for 2006–2010 only, with 21,526,910 mean annual visits.

^{***} Includes general/family practice, internal medicine, and pediatrics.

^{†††} Visits with symptoms and signs that should prompt a chlamydia test, including mucopurulent cervicitis, pelvic inflammatory disease, abnormal vaginal discharge, dyspareunia, postcoital bleeding, abnormal vaginal bleeding, or dysuria.

^{§§§} Includes birth control, sterilization, and abortion counseling, examination, or provision.

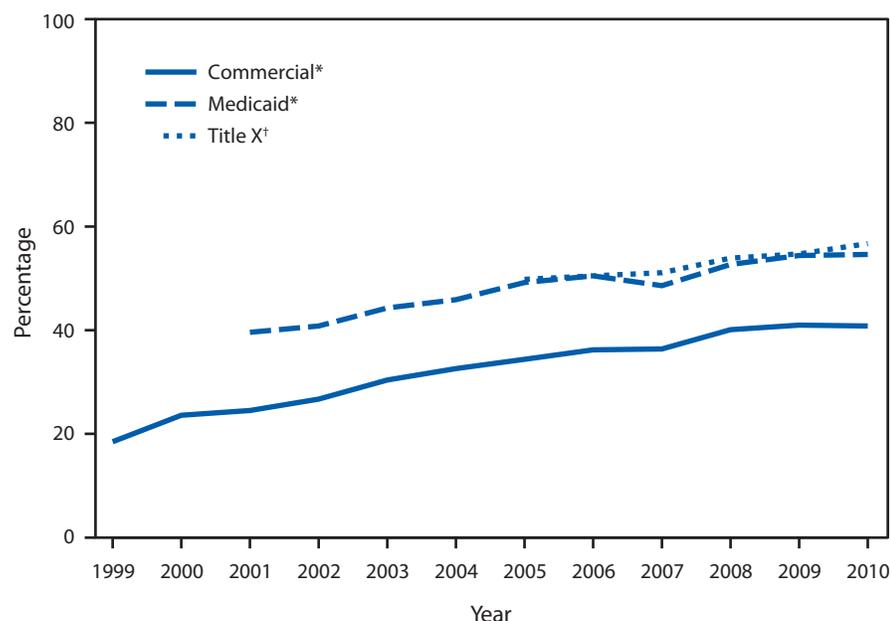
^{¶¶¶} NAMCS data available only for 2007–2010, with 21,656,080 mean annual visits.

^{****} Sum of subgroups might not match overall total due to inclusion of different years of data or rounding.

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. The Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (33). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (34); 2) vaccinations recommended by the Advisory Committee

on Immunization Practices (35); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by the Health Resources and Services Administration (HRSA) and the American Academy of Pediatrics (36) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (37); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (38). USPSTF recommends chlamydia screening as a Grade A service for sexually active nonpregnant females aged ≤24 years and for older nonpregnant women at increased risk (15). Screening is recommended as a Grade B service for pregnant females aged ≤24 years (15). State Medicaid

FIGURE. Percentage of sexually active females aged 16–20 years with commercial and Medicaid insurance and percentage of Title X family planning clinic users aged 15–19 years who were tested for chlamydia — United States, 1999–2010



* Source: Healthcare Effectiveness Data and Information Set, United States, 1999–2010. Available at <http://www.ncqa.org/ReportCards/HealthPlans/StateofHealthCareQuality.aspx>.

† Source: Title X data set, United States, 2005–2010. Available at <http://www.hhs.gov/opa/title-x-family-planning/research-and-data/fp-annual-reports>.

programs cover chlamydia screening as part of the Early and Periodic Screening, Diagnostic and Treatment benefit (39).

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.* Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including chlamydia screening.

In 2010, a total of 18% of U.S. females aged 15–21 years were uninsured (40,41). Although ACA will decrease barriers to access to chlamydia screening services, it is difficult to anticipate the extent to which use of chlamydia screening will increase. Chlamydia screening has not been used fully by those who currently have access to health care, with low rates

*The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

of screening at visits for preventive care and reproductive health services. Even as access to services without patient costsharing expands, the challenge of increasing use will remain. Barriers to screening adolescents include lack of provider skill and comfort in taking the sexual history that is required to identify sexually active adolescents who should be screened (42), and lack of disclosure of sexual behavior by adolescents (43). Patients might have concerns about lack of confidentiality caused by an explanation of benefits that is sent by a health plan to the policy holder, who is often the adolescent's parent or guardian (44). Adolescents might not have access to a health-care provider or venue where they think that their privacy would be maintained (45,46). Clinicians or adolescents might not be aware of the risk for infection. Many competing demands and priorities in an often brief clinical encounter also can be a barrier to chlamydia screening, especially given the sensitive discussion about sexual behaviors that is necessary to identify those who should be tested.

CDC, in collaboration with its public health partners, can develop and implement simple, affordable, and sustainable interventions to overcome barriers and facilitate screening of adolescents. These interventions are needed to ensure that as barriers to health care are decreased by ACA, chlamydia screening services are accessible to all sexually active females. Although toolkits and other resources have been developed (31,47,48) and widely disseminated to primary care providers including pediatricians (48,49), screening rates have been low. Possible interventions to increase screening include the use of electronic health record prompts to increase screening and retesting of those who are found positive. Prompts have been demonstrated to be most effective when used as part of a more comprehensive effort that includes additional interventions including implementation teams, training of providers, provider feedback, and panel management (50–52). Structural interventions (e.g., clinic protocols and procedures) can facilitate adherence to recommendations for screening and improve health-care system performance. The structural intervention of placing a chlamydia collection swab beside a cervical cytology kit has been demonstrated to be successful in ensuring that a chlamydia test also was performed (53). However, because cervical cancer screening guidelines no

longer recommend cervical cytologic screening for females aged <21 years (54), alternative interventions need to be developed as fewer adolescents are screened for cervical cancer and thus for chlamydia (55). Providers and patients will need to use other existing opportunities to test for chlamydia, such as at visits for preventive care, contraception, and pregnancy testing (56). In addition, the implementation of patient-centered interventions that facilitate self-collection of specimens can be effective to increase screening. Primary care providers might perform chlamydia screening more often if they were to be made aware that a test can be performed easily without a pelvic exam by using a self-collected vaginal swab specimen or urine (4). Finally, social marketing campaigns for young females, such as the Get Yourself Tested (GYT) campaign, have been demonstrated to increase patient demand for screening (57,58).

Limitations

The findings in this report are subject to at least nine limitations. First, although NSFG data are representative of all sexually active U.S. females and accurately identify females who should have been tested on the basis of their self-reported sexual activity, testing rates might be either overestimated or underestimated because females who had a chlamydia test were identified by self-report of the test. Many females who have a gynecologic examination or Pap test might incorrectly assume that a chlamydia test also was performed (59), resulting in an overestimate of testing. Females might not know that a chlamydia test was performed, and this also might lead to an underestimate of testing. Second, with NAMCS data, chlamydia tests are more accurately identified by a review of the patient's medical record, but the unit of analysis is a visit rather than a person. Young females might have had more than one visit in a year and other opportunities for testing besides the reviewed visit, possibly leading to an underestimate of testing rates. In contrast, NSFG captures testing performed in venues in addition to physician offices. Third, NAMCS data do not distinguish whether females are sexually active or not, and nonsexually active females would not require a test. This would result in an underestimate of the testing rate. However, reproductive health visits probably were made by sexually active adolescents, and rates of testing rates at these visits were also very low. Fourth, among the data sources analyzed, only NAMCS included variables to distinguish symptomatic and asymptomatic screening. In contrast, NSFG does not collect data on whether females were symptomatic or asymptomatic for chlamydial infection, so it was not possible to distinguish screening of asymptomatic females from testing of symptomatic females. Fifth, the HEDIS measure of chlamydia screening includes

only females who utilize reproductive health-care services, likely resulting in inclusion of too few females in the denominator and an overestimate of testing rates. Sixth, all female family planning clinic users were included in the analysis of Title X data on the assumption that they were all sexually active. Some users might not have been sexually active, and their inclusion in the denominator would result in an underestimate of screening rates. However, it is likely that most adolescents seeking reproductive health care at a Title X service site are sexually active. Seventh, with both HEDIS measures and Title X data, service providers might change over time, and trends in testing might reflect changes in the service providers participating in the program rather than changes within clinics. Eighth, rates calculated using HEDIS and Title X data were made on the basis of convenience samples, so the findings cannot be generalized to the U.S. population. Finally, Medicaid and Title X family planning clinic users might be at increased risk for chlamydial infection (60,61), and this might have led clinicians who care for these populations to be more likely to test for chlamydia, resulting in an overestimate of testing rates compared with the general population of U.S. adolescents.

Conclusion

In the United States, chlamydia screening rates have been suboptimal with fewer than half of sexually active females aged 15–21 years screened annually. Although testing and screening rates varied by demographic characteristics, insurance type, screening venue, and type of health-care services used, suboptimal rates indicate that improvement in screening coverage is needed. Provision of this simple, affordable, effective, and cost-effective service can protect the reproductive health of adolescents and prevent infertility and ectopic pregnancy. Interventions are needed to increase patient and provider adherence to the recommendation for annual chlamydia screening of all sexually active females aged ≤24 years.

CDC will continue to use the four data sources described in this report to monitor chlamydia screening trends. The usefulness of surveys would be enhanced by adding additional questions to ascertain whether a female was symptomatic or sexually active. Together, these data can be used to track trends in chlamydia screening and to provide valuable information for improving access and use of this important preventive service by adolescent females. Access to chlamydia screening will likely be increased with implementation of ACA, and CDC and its public health partners will use the chlamydia testing data provided in this report to develop focused interventions for at-risk groups and to identify missed opportunities for screening and testing of those who access care.

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Receipt of Reproductive Health Services Among Sexually Experienced Persons Aged 15–19 Years — National Survey of Family Growth, United States, 2006–2010

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Introduction

The prevention of pregnancy, childbirth, and sexually transmitted diseases (STDs) among teenagers has garnered recent attention both from public health and clinical organizations. In 2011, the U.S. birth rate among teenagers reached a historic low of 31.3 births per 1,000 females aged 15–19 years and has decreased 49% percent from 1991 to 2011 (1). Despite recent decreases, U.S. birth rates among teenagers remain higher than those in other industrialized countries. For example, in 2009, the U.S. teenage birth rate was approximately 1.5 times the birth rate in the United Kingdom, nearly 3 times the birth rate in Canada, and nearly 8 times the birth rate of Denmark. Approximately 20% of births to teenagers aged 15–19 years are repeat births, and significant disparities by race and ethnicity persist (1–3).

In 2011, nearly 20 million new cases of STDs were diagnosed in the United States, with numerous cases occurring among persons aged 15–19 years (4,5). STDs such as chlamydia and gonorrhea are associated with increased risk of adverse outcomes including tubal infertility, ectopic pregnancy, and chronic pelvic pain.

Access to clinical reproductive health services can improve health and reduce costs by covering pregnancy prevention and STD testing, treatment, and counseling. Improving the reproductive health of teenagers is a public health priority. For example, one *Healthy People 2020* objective (objective FP-7) is to increase by 10% the proportion of all sexually active persons who received reproductive health services in the past 12 months (6). Rules promulgated pursuant to the Patient Protection and Affordable Care Act of 2010 (as amended by the Health Care and Education Reconciliation Act of 2010 and referred to collectively as the Affordable Care Act [ACA]) require that women's health services supported by the Health Resources and Services Administration (HRSA) be provided by private insurers without copayment, including

contraception as prescribed for women (including teenagers) with reproductive capacity (7). In addition, the National Prevention Strategy highlights providing teenagers with effective, medically accurate, developmentally appropriate, evidence-based sexual education and enhancing the early detection of human immunodeficiency virus (HIV) infection, STDs, and viral hepatitis and improving linkages to clinical care (8). The National Quality Forum (NQF) endorsed two related performance measures: 1) the percentage of sexually active women aged 16–24 years who had at least one test for chlamydia in a year (NQF #0033) and 2) the percentage of teenagers with documentation of assessment or counseling for risky behavior (i.e., sexual activity and alcohol, tobacco or other substance use) by the age of 18 years (NQF #1507) (9,10).

The U.S. Preventive Services Task Force (USPSTF) recommends that all sexually active females aged ≤ 24 years receive annual screening for chlamydia. This is a USPSTF Grade A recommendation, which means that USPSTF strongly recommends the service because the certainty is high that the benefits substantially outweigh the potential harms. The same screening is recommended for gonorrhea. This is a USPSTF Grade B recommendation, which means that USPSTF recommends the service because the certainty is moderate that the benefits substantially outweigh the potential harms. USPSTF recommends that adolescents aged ≥ 15 years, as well as younger teenagers who are at increased risk, also should be screened for HIV infection (USPSTF Grade A recommendation). USPSTF also recommends that all sexually active adolescents be provided high-intensity behavioral counseling* for sexual risk reduction (USPSTF Grade B recommendation) (11). The Bright Futures guidelines, developed by the American Academy of Pediatrics (AAP)

* Successful high-intensity interventions were delivered through multiple sessions, most often in groups, with total durations of 3–9 hours. Little evidence suggests that single-session interventions or interventions lasting < 30 minutes were effective in reducing STDs.

and supported by HRSA, encourage streamlining medical care and consider clinical encounters for acute care, health maintenance visits, or sports physicals to be opportunities to teach adolescents about healthy sexuality. This approach aligns with the Medical Home Model of the National Initiative for Children's Healthcare Quality (12,13). Bright Futures guidelines recommend that adolescents, regardless of sexual experience, should receive health guidance annually on the advantages of delaying sexual activity and information on STDs and contraception, including emergency contraception (12). In addition, numerous professional organizations recommend reproductive health visits during early adolescence, which might include screening for sexual experience, screening for STDs, medically accurate reproductive health counseling, and provision of contraception when appropriate (12,14). The public health community plays a critical role in promotion of adolescent reproductive health by encouraging health-care providers to adhere to evidence-based recommendations from professional organizations and USPSTF and by monitoring progress toward achieving the *Healthy People 2020* goals. Increasing the proportion of adolescents, particularly those who are sexually experienced (i.e., have ever had penile-vaginal intercourse) who visit a health-care provider for reproductive health services is essential to promote adolescent health.

The reports in this supplement provide the public and stakeholders responsible for infant, child, and adolescent health (including public health practitioners, parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) with easily understood and transparent information about the use of selected clinical preventive services that can improve the health of infants, children, and adolescents. The topic in this report is one of 11 topics selected on the basis of existing evidence-based clinical practice recommendations or guidelines for the preventive services and availability of data system(s) for monitoring (15). This report analyzes 2006–2010 data from the National Survey of Family Growth (NSFG) to estimate the proportion of sexually experienced persons aged 15–19 years who received reproductive services during the 12 months before the interview. Researchers, policy makers, and health-care providers can use these data to track improvements in receipt of these services.

Methods

To estimate the proportion of sexually experienced persons aged 15–19 years who received reproductive health services during the 12 months before the interview, CDC analyzed 2006–2010 data from NSFG. NSFG is a nationally

representative, in-person household survey conducted by CDC that uses a stratified, multistage probability sample of females and males aged 15–44 years. A maximum of 1,389 males and 1,053 females aged 15–19 years were included as part of this analysis; the number included in each analysis varied. Survey topics include sexual activity and receipt of health services from a medical provider (16). Selected reproductive health services are based on recommendations from national organizations and *Healthy People 2020* (6,12). For females, these included contraceptive services (i.e., provision of a method or prescription, a checkup, counseling, or pregnancy test), gynecologic services (i.e., pelvic exam or Papanicolaou [Pap] smear), or STD counseling, testing, or treatment. For males, reproductive health services included advice about male and female contraception, a testicular exam, or advice about STDs, HIV, or acquired immunodeficiency syndrome (AIDS).

Respondents were considered sexually experienced if they indicated they had ever had penile-vaginal intercourse. (Adolescents who had a history of only oral sex, only anal sex, or both were not included). Female respondents were classified as receiving reproductive health services if they indicated they had received selected contraceptive, gynecologic services, or STD services from a health-care provider in the past 12 months. Male respondents were classified as receiving reproductive health services if they indicated receipt of advice about male and female contraception; a testicular exam to check for congenital abnormalities, lumps, or other abnormalities such as an undescended testicle; or advice about STDs, HIV, or AIDS.

Receipt of reproductive health services was stratified by sociodemographic characteristics: insurance coverage in the past 12 months (private, Medicaid, other public, or none); age (15–17 or 18–19 years); race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other); and maternal education (less than high school, high school equivalent, or college or greater). Receipt of reproductive health services also was stratified by sexual risk behaviors: number of sexual partners in the past 12 months (none, one, two, or three or more); age at first sex (≤ 15 years, 16–17 years, or 18–19 years); and whether females had a previous pregnancy or males had fathered a previous pregnancy. Finally, receipt of formal sex education before age 18 years was stratified by reproductive health topics (how to say no to sex, methods of birth control, STDs, and any of these three topics) and whether the adolescent had ever spoken to a parent or guardian about a reproductive health topic (how to say no to sex, methods of birth control, STDs, and any of these three topics). Differences in proportions between subgroups were assessed using a two tailed t-test. Comparisons mentioned in the text are statistically significant at the $p < 0.05$ level unless otherwise stated. All

analyses were conducted using statistical software to account for the complex sample design of NSFG.

Results

During 2006–2010, 76.5% of sexually experienced females aged 15–19 years (95% CI = 73.0%–80.1%) and 43.9% (CI = 40.6%–47.2%) of all females aged 15–19 years, regardless of sexual experience, reported receiving a reproductive health service from a health-care provider in the past 12 months (Figure). Approximately 70% of sexually experienced females received any contraceptive service (method or prescription, counseling, checkup, or test), 57.1% (CI = 53.4%–60.9%) received any gynecologic service (Pap smear or pelvic examination), and 31.2% (CI = 27.5%–34.9%) received STD counseling, testing, or treatment. The most commonly received services were a Pap smear (53.7% [CI = 50.2%–57.2%]) and a contraceptive method or prescription (53.6% [CI = 49.4%–57.9%]). Similarly, 62.5% (CI = 56.9%–68.2%) of sexually experienced males aged 15–19 years and 58.2% (CI = 55.1%–61.3%) of all males aged 15–19 years, regardless of sexual experience, received a reproductive health service from a health-care provider in the past 12 months (Figure). The majority (55.5% [CI = 50.2%–60.8%]) of sexually experienced males received a testicular exam to screen for testicular cancer, whereas 22.8% (CI = 17.4%–28.2%) received advice about male or female contraception, and 26.1% (CI = 19.6%–35.6%) received advice about HIV or other STDs.

The percentage of sexually experienced females aged 15–19 years who received reproductive health services is shown by select characteristics (Table 1). Sexually experienced females with insurance coverage in the past 12 months, regardless of the type of coverage, reported a significantly higher prevalence of receiving any reproductive health service than did those without insurance coverage (private, 77.3%; Medicaid, 78.6%; other public, 82.4%; and no insurance, 60.9%). Receipt of any reproductive health service and of any contraceptive service differed significantly by age, with females aged 18–19 years reporting a higher prevalence of receiving both reproductive health services and contraceptive services (81.0% and 74.0%, respectively) than younger teenagers aged 15–17 years (68.2% and 63.0%, respectively) (Table 1). Compared with females with no sexual partners during the past 12 months, females with one or more sexual partners reported a higher prevalence of receiving any reproductive health service (zero partners, 48.7%; one partner, 79.8%; two partners, 76.3%; and three or more partners: 79.1%). Females who stated they had never been pregnant (91.7%) reported a higher prevalence of

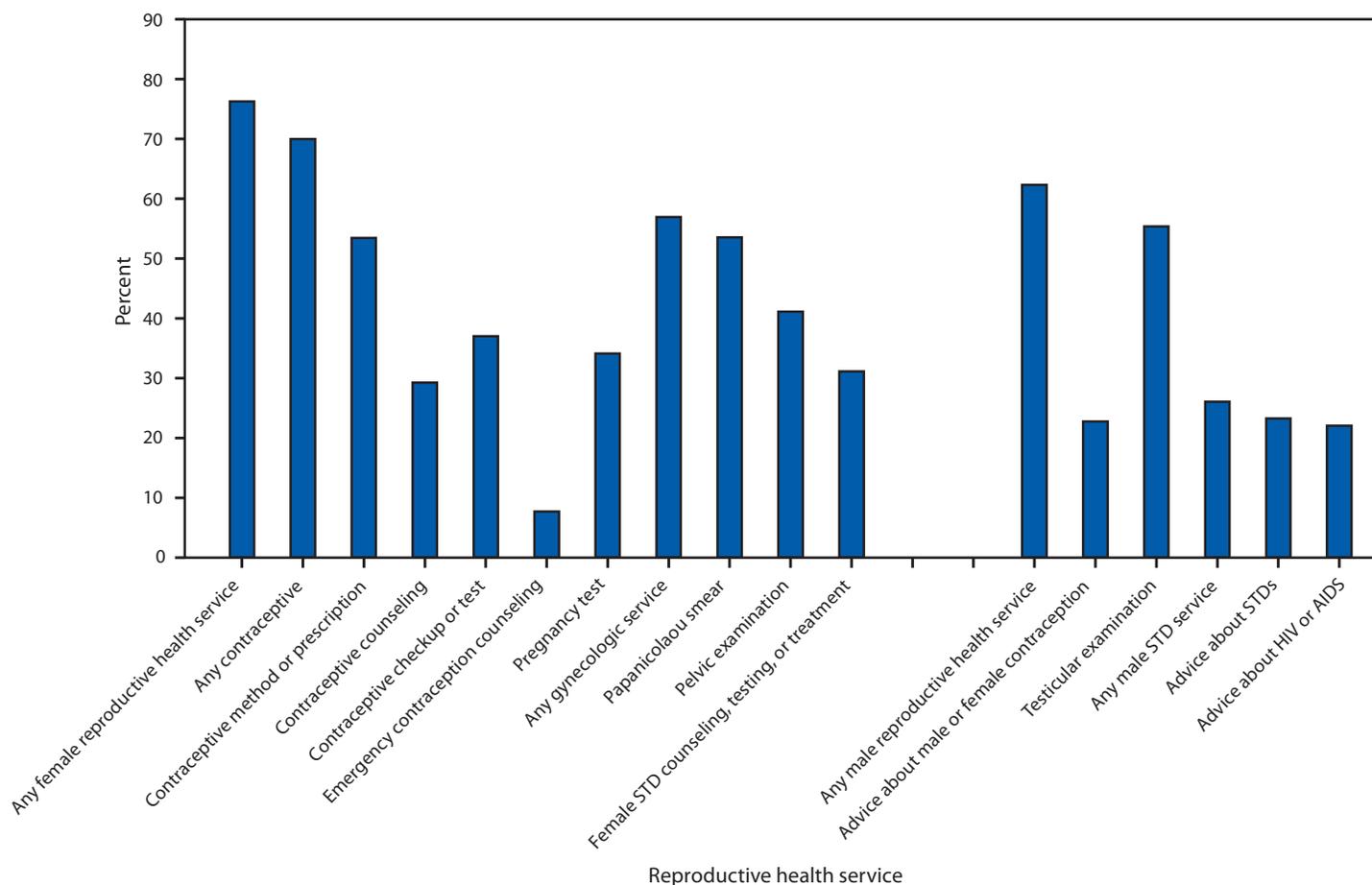
receiving any reproductive health service than those who stated they had ever been pregnant (71.2%). Those who had received formal sex education on methods of birth control reported a higher prevalence of receiving any reproductive health service (79.1%) and any contraceptive service (72.9%) than those who had not (67.3% and 60.3%, respectively). Females who had spoken with a parent or guardian about any reproductive health topic (including how to say no to sex, methods of birth control, and STDs) had a higher prevalence of receiving any reproductive health service and any contraceptive service (79.0% and 73.5%, respectively) compared with those who had not (66.6% and 56.9%, respectively).

The percentage of sexually experienced males aged 15–19 years who received reproductive health services is shown by select characteristics (Table 2). Among sexually experienced males, having insurance coverage in the past 12 months, regardless of the type of coverage, was associated with a higher prevalence of receiving any reproductive health service than those without insurance coverage (private, 61.7%; Medicaid, 69.1%; other public, 65.4%; and no insurance, 43.4%) (Table 2). Males who had fathered a previous pregnancy reported a higher prevalence of both receiving advice about male or female contraception (34.3%) and any STD service (39.2%) than did males who reported never having fathered a pregnancy (20.9% and 24.0%, respectively). Males who had received formal sex education on how to say no to sex reported a higher prevalence of receiving any reproductive health service (65.1%) than did males who had not (52.9%). Those who had received formal sex education on methods of birth control or on STDs were as likely to have received reproductive health services as those who had not received formal sex education. Compared with sexually experienced males who had not spoken with their parent or guardian about a reproductive health topic (i.e., how to say no to sex, methods of birth control, or STDs), those who had spoken with a parent or guardian about a reproductive health topic had a higher prevalence of having received any reproductive health service (66.3% versus 53.8%), advice about male or female contraception (27.2% versus 12.5%), any STD service (29.2% versus 18.9%), and a testicular examination (59.6% versus 45.9%).

Discussion

The majority of sexually experienced persons aged 15–19 years received a reproductive health service from a health-care provider in the 12 months before the interview. Those with insurance coverage (regardless of type), who received formal sex education, and who spoke with a parent or guardian about any

FIGURE. Receipt of reproductive health services by sexually experienced* persons aged 15–19 years in the past 12 months — United States, National Survey of Family Growth, 2006–2010.



Abbreviations: AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus; STD = sexually transmitted disease.
* Persons who have ever had penile-vaginal sex.

reproductive or sexual health topic had the highest prevalence of receiving reproductive health services. However, many did not receive needed reproductive health services. During the 12 months before the interview, approximately 30% of sexually experienced females aged 15–19 years did not receive contraceptive services, nearly 70% of sexually experienced females aged 15–19 years did not receive recommended STD services, and 74% of sexually experienced males aged 15–19 years did not receive STD services. Persons aged 15–19 years without insurance coverage, younger females aged 15–17 years, and persons aged 15–19 years with a previous pregnancy also had a lower prevalence of receiving reproductive health services.

Ongoing changes in the U.S. health-care system offer opportunities to improve the use of clinical preventive services among infants, children, and adolescents. ACA expands insurance coverage, consumer protections, and access to

care and places a greater emphasis on prevention (17). As of September 23, 2010, ACA § 1001 requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services, including 1) recommended services of USPSTF graded A (strongly recommended) or B (recommended) (18); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (19); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by HRSA and AAP (12) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (20); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (21). Therefore, pursuant to guidelines supported by HRSA, new private health plans must provide coverage without cost-sharing for contraceptive methods and sterilization procedures

TABLE 1. Percentage of sexually experienced* females aged 15–19 years who received reproductive health services† in the past 12 months, by select characteristics — National Survey of Family Growth, United States, 2006–2010

Characteristic	Receipt of any reproductive health service		Receipt of any contraceptive service		Receipt of any STD service		Receipt of any gynecologic service	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Insurance coverage								
Private	77.3 [§]	(72.1–82.6)	71.2	(65.5–76.9)	28.5	(23.7–33.3)	56.8	(51.2–62.4)
Medicaid	78.6 [§]	(73.1–84.0)	71.7	(65.7–77.7)	37.1	(31.1–43.0)	63.0	(56.7–69.3)
Other public	82.4 [§]	(74.6–90.3)	76.6	(67.7–85.4)	35.9	(24.9–46.9)	53.6	(43.5–63.6)
None	60.9 [§]	(44.9–77.0)	52.6	(36.2–69.1)	25.2	(12.1–38.3)	46.2	(29.6–62.8)
Age (yrs)								
15–17	68.2 [§]	(62.9–73.6)	63.0 [§]	(57.1–68.8)	30.9	(24.8–37.0)	38.8	(33.0–44.6)
18–19	81.0 [§]	(76.6–85.5)	74.0 [§]	(69.1–78.9)	31.3	(26.6–36.0)	67.0	(62.0–71.9)
Race/Ethnicity								
White, non-Hispanic	77.1	(72.4–81.7)	72.7	(67.7–77.7)	28.4 [§]	(23.4–33.4)	56.4 [§]	(51.3–61.6)
Black, non-Hispanic	81.2	(72.4–81.7)	71.1	(64.0–78.1)	41.5 [§]	(33.7–49.3)	67.2 [§]	(59.4–75.0)
Hispanic	74.0	(67.4–80.5)	67.5	(60.0–74.9)	33.7 [§]	(24.1–43.4)	55.7 [§]	(48.4–63.1)
Other	66.4	(42.0–90.7)	51.7	(28.0–75.3)	21.0 [§]	(10.3–31.7)	39.6 [§]	(23.0–56.3)
Maternal education								
Less than high school	75.3	(67.9–82.7)	67.8	(59.8–75.9)	36.1	(27.2–45.1)	52.3	(44.3–60.3)
High school equivalent	76.9	(70.2–83.5)	72.6	(65.8–79.5)	31.0	(23.7–38.3)	58.8	(51.9–65.7)
College or greater	76.8	(71.9–81.7)	69.6	(64.7–74.6)	29.6	(24.5–34.6)	57.8	(52.3–63.3)
Sex partners in past 12 months								
None	48.7 [§]	(34.5–63.0)	34.6 [§]	(20.7–48.6)	17.9 [§]	(9.0–26.8)	33.0 [§]	(20.9–45.1)
One	79.8 [§]	(75.6–84.0)	74.6 [§]	(69.9–79.3)	30.4 [§]	(25.6–35.1)	59.4 [§]	(54.1–64.6)
Two	76.3 [§]	(67.3–85.3)	71.7 [§]	(62.6–80.9)	30.8 [§]	(22.9–38.7)	56.6 [§]	(47.5–65.7)
Three or more	79.1 [§]	(69.9–88.4)	70.1 [§]	(59.9–80.3)	42.2 [§]	(29.5–54.8)	61.9 [§]	(50.2–73.7)
Age at first sex (yrs)								
≤15	76.4	(71.3–81.4)	69.7	(64.5–74.9)	33.7	(28.2–39.1)	54.3	(49.1–59.4)
16–17	77.3	(72.1–82.6)	72.3	(67.1–77.4)	30.5	(24.9–36.1)	60.3	(54.1–66.6)
18–19	73.8	(59.2–88.4)	63.2	(46.3–80.1)	20.6	(10.4–30.8)	58.2	(43.0–73.5)
Previous pregnancy								
Yes	71.2 [§]	(66.8–75.6)	64.7 [§]	(60.0–69.3)	26.4 [§]	(22.2–30.5)	49.3 [§]	(44.8–53.8)
No	91.7 [§]	(87.4–96.0)	85.8 [§]	(71.1–90.6)	45.0 [§]	(37.6–52.3)	79.4 [§]	(72.9–85.8)
Previous STD diagnosis								
Yes	87.8	(75.5–100.0)	83.0	(69.3–96.6)	46.7	(27.6–65.8)	73.0	(55.2–90.8)
No	75.9	(72.2–79.6)	69.4	(65.7–73.2)	30.4	(26.5–34.2)	57.4	(52.5–60.1)

See table footnotes on page 94.

approved by the Food and Drug Administration and patient education and counseling for all women with reproductive capacity (7). Most state Medicaid/Children's Health Insurance Program programs cover various forms of pregnancy prevention and reproductive health services for teenagers as part of their family planning services.

The Health Insurance Marketplace (or Health Insurance Exchange) began providing access to private health insurance for small employers and to persons and families interested in exploring their options for coverage, with policies taking effect as early as January 2014.† Federal tax credits are available on a sliding scale to assist those living at 100%–400% of the

federal poverty level who purchase health insurance through the Marketplace (ACA § 1401). Insurance plans sold on the Marketplace must cover the four types of recommended clinical preventive services without cost-sharing, including contraceptive methods and sterilization procedures approved by the Food and Drug Administration and patient education and counseling for all women with reproductive capacity.

Pregnancy prevention and reproductive health services for teenagers also are mentioned in several places in ACA. The law provides states the option to provide family planning services to eligible pregnant and nonpregnant women (ACA § 2303) and provides grants to implement innovative strategies that educate teenagers on both abstinence and contraception to prevent pregnancy and STDs (ACA § 2953). The law also establishes a Pregnancy Assistance Fund to establish or maintain services for pregnant and parenting teens and women (ACA § 10212).

Contraception has been shown to be highly effective at preventing unintended pregnancy (especially long-acting

† The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

TABLE 1. (Continued) Percentage of sexually experienced* females aged 15–19 years who received reproductive health services† in the past 12 months, by select characteristics — National Survey of Family Growth, United States, 2006–2010

Characteristic	Receipt of any reproductive health service		Receipt of any contraceptive service		Receipt of any STD service		Receipt of any gynecologic service	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Received formal sex education on specific topics before age 18 yrs								
How to say no to sex								
Yes	76.9	(73.2–80.6)	70.7	(66.8–74.5)	31.6	(27.6–35.6)	57.2	(52.9–61.3)
No	74.2	(63.0–85.3)	66.3	(54.2–78.5)	28.2	(18.5–37.9)	57.0	(45.6–68.4)
Methods of birth control								
Yes	79.1 [§]	(75.1–83.2)	72.9 [§]	(68.9–77.0)	30.8	(26.4–35.2)	57.9	(53.1–62.7)
No	67.3 [§]	(59.3–75.2)	60.3 [§]	(52.7–68.0)	32.6	(25.1–40.0)	54.5	(47.3–61.7)
STDs								
Yes	76.6	(72.9–80.3)	70.2	(66.3–74.0)	31.4	(27.6–35.3)	57.0	(53.1–61.0)
No	75.6	(63.6–87.6)	70.0	(56.4–83.6)	26.9	(15.3–38.5)	58.8	(44.7–73.0)
Any topic								
Yes	76.6	(72.9–80.4)	70.1	(66.2–73.9)	31.5	(27.7–35.3)	57.0	(53.1–60.9)
No	75.9	(53.8–98.0)	73.3	(51.5–95.1)	19.4	(2.4–36.4)	60.1	(33.2–87.0)
Ever spoke to parent guardian about specific reproductive health topics								
How to say no to sex								
Yes	77.9	(73.5–82.3)	72.6	(68.0–77.3)	33.8	(28.6–39.0)	57.3	(52.4–62.1)
No	74.7	(68.9–80.5)	66.8	(60.8–72.8)	27.7	(22.7–32.6)	56.9	(50.5–63.3)
Methods of birth control								
Yes	81.1 [§]	(77.5–84.8)	75.9 [§]	(71.8–80.1)	32.5	(38.0–37.0)	59.0	(54.8–63.1)
No	66.5 [§]	(59.2–73.8)	57.6 [§]	(50.5–64.6)	28.2	(22.7–33.8)	53.1	(45.8–60.4)
STDs								
Yes	80.3 [§]	(76.2–84.4)	74.3 [§]	(69.8–78.9)	34.4	(29.9–39.0)	59.6 [§]	(54.7–64.5)
No	71.2 [§]	(65.1–77.3)	64.3 [§]	(57.8–70.8)	26.6	(21.4–31.8)	53.6 [§]	(47.6–59.7)
Any topic								
Yes	79.0 [§]	(75.5–82.6)	73.5 [§]	(69.7–77.2)	32.2	(27.9–36.5)	58.0	(53.9–62.2)
No	66.6 [§]	(56.7–76.5)	56.9 [§]	(47.1–66.8)	27.1	(20.1–34.2)	53.5	(43.6–63.4)
Total (n = 1,053)	76.5	(73.0–80.1)	70.2	(66.5–73.9)	31.2	(27.5–34.9)	57.1	(53.4–60.9)

Abbreviations: CI = confidence interval; STD = sexually transmitted disease.

* Persons who have ever had penile-vaginal intercourse.

† Reproductive health services are defined as contraceptive services (provision of a method or prescription, a checkup, counseling, or pregnancy test), gynecologic services (a pelvic examination or Papanicolaou smear), or STD counseling, testing, or treatment.

§ Statistically significant difference (two tailed t-test, $p < 0.05$).

reversible contraceptive methods such as intrauterine devices and implants) and is very cost-effective, with >\$4 saved for every \$1 invested (22,23,25,27). USPSTF has made evidence-based recommendations to provide the following reproductive health services to teenage clients: screening for STDs such as chlamydia, gonorrhea, and HIV infection (16) and counseling for sexual behavior that place teens at high risk for STDs and pregnancy (11). On the other hand, because of recent changes to USPSTF recommendations, health-care providers might need to stop providing some reproductive health services to adolescents. USPSTF specifically recommends against the provision of services that many teenagers reported receiving. For example, testicular examinations for adolescent and adult males are not recommended (USPSTF Grade D recommendation) because the potential harms of routine screening outweigh the benefits; however, 56% of males in the sample in this report indicated that they received a testicular examination. Pap smears are no longer recommended for

women aged <21 years, and pelvic examinations are only recommended when an indication exists (e.g., pelvic pain or a suspected STD) or at the initiation of an intrauterine device or a diaphragm (24,25). Unnecessary procedures such as pelvic examinations are barriers to use of services by adolescents; removing these barriers to care could improve receipt of vital reproductive health services (26).

Professional organizations recommend that female teenagers start reproductive health visits that include screening for sexual activity, medically accurate sexual health and reproductive health counseling, and contraceptive access for those who are sexually active in early adolescence. Given that female teenagers can only obtain hormonal contraception and intrauterine devices from a health-care provider, regular reproductive health visits for teenagers can facilitate access to contraception and a subsequent decrease in pregnancies among teenagers (12,27).

Another important aspect of reproductive health visits involving adolescents is confidentiality. Because many

TABLE 2. Percentage of sexually experienced males* aged 15–19 years who received reproductive health services† in the past 12 months, by select characteristics — National Survey of Family Growth, United States, 2006–2010

Characteristic	Receipt of any reproductive health service		Receipt of advice about male or female contraception		Receipt of any STD service		Receipt of a testicular examination	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Insurance coverage								
Private	61.7 [§]	(55.6–67.9)	22.7	(17.3–28.2)	21.8 [§]	(16.7–26.9)	55.9 [§]	(49.9–61.9)
Medicaid	69.1 [§]	(61.3–76.9)	22.8	(16.2–29.3)	33.3 [§]	(27.1–39.5)	60.4 [§]	(52.3–68.5)
Other public	65.4 [§]	(53.7–77.2)	30.1	(18.0–42.1)	34.2 [§]	(21.6–46.8)	58.2 [§]	(46.0–70.3)
None	43.4 [§]	(29.2–57.6)	16.6	(7.7–25.4)	22.3 [§]	(11.1–33.6)	31.7 [§]	(18.9–44.5)
Age (yrs)								
15–17	68.8	(60.1–77.5)	23.8	(18.9–28.7)	26.6	(20.9–32.2)	61.5 [§]	(55.2–67.7)
18–19	58.3	(53.8–62.7)	22.0	(17.4–26.7)	25.8	(21.6–30.0)	51.4 [§]	(45.7–57.0)
Race/Ethnicity								
White, non-Hispanic	64.4 [§]	(54.6–74.2)	22.8	(16.9–28.8)	22.6	(18.0–27.2)	58.7 [§]	(52.3–65.2)
Black, non-Hispanic	68.2 [§]	(57.4–79.0)	27.8	(16.9–28.8)	33.3	(26.7–40.0)	61.0 [§]	(53.5–68.4)
Hispanic	50.3 [§]	(45.9–54.6)	18.8	(12.3–25.4)	26.7	(18.8–34.6)	39.9 [§]	(33.0–46.8)
Other	68.6 [§]	(45.5–91.7)	17.4	(6.7–28.2)	28.8	(14.3–43.3)	60.9 [§]	(48.3–73.4)
Maternal education								
Less than high school	50.8	(41.3–60.3)	21.9	(13.6–30.1)	28.7 [§]	(19.6–37.8)	43.1	(33.7–52.4)
High school equivalent	65.6	(58.7–72.4)	24.0	(16.9–31.0)	29.3 [§]	(23.2–35.4)	57.4	(50.2–64.6)
College or greater	63.6	(57.8–69.4)	22.3	(17.3–27.3)	23.1 [§]	(18.3–27.8)	57.6	(52.2–63.0)
Sex partners in past 12 months								
None	59.2	(47.7–70.7)	11.7 [§]	(3.8–19.7)	25.8	(16.4–35.2)	52.4	(40.8–63.9)
One	61.6	(55.3–68.0)	20.6 [§]	(15.7–25.6)	25.4	(20.0–30.7)	54.3	(48.2–60.4)
Two	65.4	(56.9–73.9)	26.1 [§]	(18.3–34.0)	24.8	(18.3–31.4)	58.6	(49.3–67.9)
Three or more	63.6	(54.6–72.7)	31.0 [§]	(22.4–39.5)	29.7	(21.0–38.4)	57.0	(48.5–65.4)
Age at first sex (yrs)								
≤15	63.4	(58.6–68.3)	24.0	(19.8–28.2)	28.9	(25.0–32.8)	56.0	(50.9–61.2)
16–17	63.6	(56.1–69.1)	21.3	(15.5–27.1)	22.0	(16.7–27.3)	56.8	(50.8–62.9)
18–19	55.8	(40.1–71.5)	20.6	(7.1–34.1)	27.3	(12.4–42.3)	45.6	(29.3–61.8)
Fathered a previous pregnancy								
Yes	62.6	(54.0–71.3)	34.3 [§]	(23.5–45.0)	39.2 [§]	(29.1–49.4)	51.0	(41.6–60.3)
No	62.5	(57.7–67.4)	20.9 [§]	(16.9–25.0)	24.0 [§]	(20.3–27.7)	56.2	(51.5–60.9)
Previous STD diagnosis								
Yes	65.9	(34.5–97.3)	27.0	(0.0–55.3)	46.5	(16.5–76.6)	54.8	(22.7–56.8)
No	62.4	(58.1–66.8)	22.6	(18.8–26.4)	25.7	(22.3–29.0)	55.4	(51.2–59.5)

See table footnotes on page 96.

insurance providers send an explanation of benefits that specifies each clinical service received, teenagers might be reluctant to use their health insurance (obtained through their parents) to ensure that their reproductive health services are kept confidential (19,28–32). Although many adolescents reported speaking to their parents about their sexual and reproductive health, adolescents who request confidential services should be able to receive them.

This report shows that lack of insurance coverage is a considerable barrier to use of clinical preventive services. Measures to increase health-care access through expanded health insurance are likely to increase the use of reproductive health services among adolescents. Giving adolescents the skills to make informed decisions about reproductive health and that encourage parent-child communication might also be helpful. Health-care providers need to be more aware of recent recommendations regarding appropriate reproductive services for adolescents. Efforts to increase use of reproductive health

services should target youths who are least likely to receive recommended services (e.g., younger adolescents and those without parental support).

CDC, in collaboration with the U.S. Department of Health and Human Services' Office of Adolescent Health and several state and local community-based organizations, is using evidence-based strategies to reduce rates of teen pregnancy and birth in communities with the highest rates, with a focus on African American and Hispanic persons aged 15–19 years. One component of this 5-year project focuses on increasing access among teenagers to contraceptive and reproductive health-care services by establishing linkages between community-based organizations and health-care providers and by ensuring that clinicians provide teen-friendly, culturally competent reproductive health-care services (32). CDC also is partnering with AAP to develop training for providers on how to screen and counsel adolescents on sexual activity and contraceptive use.

TABLE 2. (Continued) Percentage of sexually experienced males* aged 15–19 years who received reproductive health services† in the 12 months before the interview, by select characteristics — National Survey of Family Growth, United States, 2006–2010

Characteristic	Receipt of any reproductive health service		Receipt of advice about male or female contraception		Receipt of any STD service		Receipt of a testicular examination	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Received formal sex education on specific topics before age 18 yrs								
How to say no to sex								
Yes	65.1 [§]	(60.3–69.9)	23.3	(19.1–27.5)	27.5	(23.4–31.6)	57.4	(52.9–62.0)
No	52.9 [§]	(42.0–63.7)	20.7	(13.2–28.3)	20.7	(14.2–27.3)	48.0	(37.5–58.6)
Methods of birth control								
Yes	65.2	(59.6–70.9)	24.6	(19.8–29.4)	26.7	(22.5–30.9)	58.4	(53.0–63.8)
No	58.9	(51.9–65.9)	20.0	(14.5–25.5)	25.4	(19.8–31.1)	51.4	(44.3–58.6)
STDs								
Yes	63.0	(58.6–67.4)	22.8	(18.9–26.7)	26.0	(22.5–29.5)	56.2	(52.0–60.4)
No	56.1	(42.0–70.2)	21.9	(8.7–35.2)	27.6	(15.0–40.1)	44.8	(31.1–58.5)
Any topic								
Yes	62.8	(58.5–67.2)	22.5	(18.6–26.3)	26.0	(22.6–29.3)	56.0	(51.9–60.2)
No	51.2	(27.0–75.3)	35.2	(12.7–57.7)	31.1	(9.0–53.3)	33.5	(12.0–54.9)
Ever spoke to parent guardian about specific reproductive health topics								
How to say no to sex								
Yes	68.8 [§]	(61.7–75.8)	28.6 [§]	(21.4–35.7)	28.5 [§]	(22.2–34.8)	62.6	(56.1–69.1)
No	58.4 [§]	(53.1–63.7)	18.9 [§]	(14.9–22.9)	24.5 [§]	(20.4–28.6)	50.7	(45.5–56.0)
Methods of birth control								
Yes	68.1 [§]	(61.3–74.9)	33.9 [§]	(26.6–41.2)	32.4	(26.6–38.3)	59.3 [§]	(52.6–67.0)
No	58.7 [§]	(53.5–63.9)	15.0 [§]	(11.2–18.8)	21.7	(17.9–25.4)	52.9 [§]	(47.8–57.9)
STDs								
Yes	67.1 [§]	(61.3–72.8)	28.4 [§]	(23.1–33.7)	28.5 [§]	(23.6–33.3)	61.9	(56.1–67.8)
No	56.3 [§]	(50.1–62.4)	15.0 [§]	(10.4–19.6)	22.8 [§]	(18.0–27.7)	46.5	(41.3–51.8)
Any topic								
Yes	66.3 [§]	(61.2–71.5)	27.2 [§]	(22.2–32.2)	29.2 [§]	(24.7–33.8)	59.6 [§]	(54.6–64.6)
No	53.8 [§]	(46.4–61.2)	12.5 [§]	(8.2–16.9)	18.9 [§]	(14.0–23.7)	45.9 [§]	(39.6–52.3)
Total (n = 1,389)	62.5	(56.9–68.2)	22.8	(17.4–28.2)	26.1	(19.6–35.6)	55.5	(50.2–60.8)

Abbreviations: AIDS = acquired immunodeficiency syndrome; CI = confidence interval; HIV = human immunodeficiency virus; STD = sexually transmitted disease.

* Persons who have ever had penile-vaginal intercourse.

† Reproductive health services are defined as the following advice about male and female contraception, a testicular examination, or advice about STDs, HIV, or AIDS.

§ Statistically significant difference (two tailed t-test, p<0.05).

Key stakeholders (e.g., schools, community-based organizations, and faith-based organizations) can improve the use of reproductive health services by providing evidence-based reproductive health education, supporting parents' efforts to speak with their children about reproductive health (including pregnancy prevention) as recommended by CDC's *Community Guide for Preventive Services*, and connecting adolescents to health-care providers for reproductive health services. Key professional medical associations recommend that health-care providers provide teenagers with access to an array of contraceptive methods and medically accurate reproductive health counseling (33–35). Topics could include the safety of contraception and the importance of consistent and correct use of contraception, particularly condoms because of the added protection from STDs, including HIV infection. Finally, health-care providers should be aware that all contraceptive methods, including long-acting reversible contraception (i.e., intrauterine devices and implants) have not been documented to cause long-term adverse effects when used

by teenagers and are recommended for use by various professional organizations (27,36).

Births among teenagers cost an estimated \$10.9 billion each year in health-care and child welfare expenditures, increased incarceration rates among children of teenage parents, and lost tax revenue from lower income and future potential earnings among the children of teenage parents during their own adult lifetimes (37). Furthermore, a 2004 report estimates that the total cost of STD cases among persons aged 15–24 years was approximately \$6.4 billion (38). Ensuring access to clinical reproductive health services can save billions of dollars and allow for funds to be spent on other public health issues.

Limitations

The findings in this report are subject to at least two limitations. First, because data on the receipt of reproductive

health services are self-reported and were not verified by clinical record assessment, the actual services received might have been underestimated. Second, because of social response bias, teenagers might underestimate or overestimate their receipt of reproductive health services. The data are derived from adolescents' self-report of previous sexual intercourse, and certain respondents might not have wanted to admit to a history of sexual activity. In addition, adolescents who reported engaging in oral or anal sex but not sexual intercourse were not included; however, oral and anal sex can cause STDs, which also might have resulted in an underestimate.

Conclusion

Many adolescents are not receiving recommended preventive reproductive health services. Recent changes in health care related to reducing or eliminating copayments might increase the number of adolescents who receive these essential preventive services, including contraception and STD services. Simply making services available is unlikely to be sufficient to increase use. Teenagers should be educated, parents should be engaged, and health-care providers should be given the necessary skills to support increased use of reproductive health services by adolescents. Because this report provides baseline estimates of receipt of reproductive health services by sociodemographic and sexual risk behaviors of adolescents, the data can be used to monitor improvements in the receipt of clinical reproductive health services by adolescents over time to ensure achievement of national health goals and improvements in the reproductive health of adolescents.

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Conclusions and Future Directions for Periodic Reporting on the Use of Selected Clinical Preventive Services to Improve the Health of Infants, Children, and Adolescents — United States

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The findings described in this supplement can help improve collaboration among public health and other stakeholders who influence infant, child, and adolescent health (e.g., parents or guardians and their employers, health plans, health professionals, schools, child care facilities, community groups, and voluntary associations) to increase the use of selected clinical preventive services among U.S. infants, children, and adolescents. Increased use can substantially reduce illness and long-term disability and improve health and quality of life (1–21). This supplement underscores that the use of the clinical preventive services among U.S. infants, children, and adolescents is not optimal and is variable, ranging from <10% to approximately 85%, depending on the particular service (Table). Use was particularly low for developmental screening and receipt of dental preventive services in young children, and for human papillomavirus (HPV) vaccination and tobacco cessation assistance, including counseling, in adolescents; however, opportunities exist to improve use of all of these services (2–12). Children and adolescents with no insurance and those with no usual source of health care (if available for analysis) were the groups least likely to have used the services (2–12). Use among the uninsured ranged from 1–39 percentage points below the general population averages, suggesting that improvements in insurance coverage that will result from the implementation of health-care reform are likely to increase use of these clinical preventive services. In 2012, a total of 4.9 million children (6.6% of children) were uninsured at the time of interview (22), and approximately 15% of eligible children in the United States are not enrolled in Medicaid and Children's Health Insurance Program (CHIP) programs (23). In addition, although opportunities exist for

greater insurance coverage and for use of recommended clinical preventive services under the Patient Protection and Affordable Care Act of 2010 (P.L. 111–148), as amended by the Health Care and Education Reconciliation Act of 2010 (P.L. 111–152, together referred to as the Affordable Care Act [ACA]) (13), a survey among the uninsured found a low level of awareness of the Health Insurance Marketplace (or Health Insurance Exchange) that can be used by families to acquire insurance or Medicaid coverage (24). The survey highlights the importance of focused efforts by governmental health agencies and other stakeholders to enroll uninsured children and adolescents in health plans. Also, although use of clinical preventive services in insured populations was greater than among the uninsured, use among the insured was generally <85%, and often much less (2–12). Therefore, having health insurance coverage alone might not be sufficient to optimize use of clinical preventive services, and additional measures to improve use probably will be necessary.

Key Findings and Opportunities

The findings in this supplement document suboptimal rates of use for many of the recommended clinical preventive services for infants, children, and adolescents which, if used at optimal rates, could make important and measureable contributions to reducing illness, long-term disability, and improvements in health and quality of life (1–21). In general, use of clinical preventive services was lower in infants, children, and adolescents without insurance coverage, with low family income, with low education level by head of household,

TABLE. Percentage of patients who are receiving selected clinical preventive services for infants, children, and adolescents — United States

Topic/Indicator (years received)	% receiving service
Breastfeeding counseling (2010)	
Women with recent live births who reported receiving any advice about breastfeeding during prenatal care visits	82.7*
Hearing screening and follow-up (2009–2010)	
Infants who failed their hearing screening and then received diagnostic testing needed to confirm hearing loss	50.3†
Developmental screening (2007)	
Children aged 10–47 months whose parents were asked by health-care providers to complete a formal screen for developmental delays during the preceding 12 months	21.1 [§]
Lead screening (2010)	
Children aged 1–2 years who were screened and reported to CDC for lead poisoning	33.4 [¶]
Vision screening (2009–2010)	
Children aged 5 years who were reported by their parents to have ever had their vision checked by a doctor or other health provider	77.9**
Hypertension screening (2009–2010)	
Provider reported office-based and hospital outpatient department preventive care visits with documentation of blood pressure measurement among children and adolescents aged 3–17 years	75.7 ^{††}
Children and adolescents aged 3–17 years were reported by their parents or caregivers to have had their blood pressure measured by a doctor or other health provider at a nonemergency care physician or clinic visit during the preceding year	69.6 ^{††}
Dental care and dental preventive services (2005–2010)	
Persons aged ≤21 years who have visited the dentist during the preceding year (2009)	43.8 ^{§§}
Persons aged ≤21 years who have received dental preventive services (topical fluoride, sealant, or both) during the preceding year (2009)	14.2 ^{§§}
Persons aged 5–19 years who have a dental sealant (2005–2010)	31.3 ^{§§}
Human papillomavirus (HPV) vaccination (2011)	
Adolescents females aged 13–17 years who have received ≥1 dose of the HPV vaccine	53.0 ^{¶¶}
Adolescent females aged 13–17 years who have received ≥3 doses of the HPV vaccine	34.8 ^{¶¶}
Adolescent males aged 13–17 years who have received ≥1 dose of the HPV vaccine***	8.3 ^{¶¶}
Adolescent males aged 13–17 years who have received ≥3 doses of the HPV vaccine***	1.3 ^{¶¶}
Tobacco use screening and cessation assistance (2004–2010)	
Provider reported office-based outpatient visits with documentation of tobacco use status among persons aged 11–21 years	69.5 ^{†††}
Provider reported office-based outpatient visits with documentation of tobacco cessation assistance, including counseling and/or a prescription or order for a cessation medication among current tobacco users in persons aged 11–21 years	19.8 ^{†††}
Chlamydia screening (2005–2010)	
Sexually active females aged 15–21 years who reported being tested for chlamydia during the preceding 12 months (2006–2010)	40.0 ^{§§§}
Provider reported office-based ambulatory care setting visits with screening for chlamydia among females aged 15–21 years (2005–2010)	4.3 ^{§§§}
Reproductive health services (2006–2010)	
Sexually experienced females aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	76.5 ^{¶¶¶}
All females aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	43.9 ^{¶¶¶}
Sexually experienced males aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	62.5 ^{¶¶¶}
All males aged 15–19 years who reported receiving a reproductive health service from a health-care provider during the preceding 12 months	58.2 ^{¶¶¶}

See table footnotes on page 101.

without a usual source of medical care/medical home, or from minority racial/ethnic groups as compared to children with insurance, with higher income, with higher education level by head of household, with a medical home, or from majority racial/ethnic groups. Each of the 11 reports in this supplement identifies opportunities to leverage available public health and clinical strategies at the local and community, state, and/or federal levels to improve use of clinical preventive services for infants, children, and adolescents.

Despite the fact that 83% of women had received breastfeeding counseling during prenatal care visits in 2010, only approximately 50% of women breastfed their infant to any extent 6 months after birth. Expanding access to comprehensive support and counseling from trained providers during prenatal

and postpartum period and infancy and breastfeeding supplies is vital to improve breastfeeding practice.

During infancy, early detection of conditions through hearing screening and continuous developmental screening mitigates long-term disability and helps ensure overall health and quality of life.

- During 2009–2010, approximately 50% of infants who failed their hearing screening were not documented to have received testing needed to diagnose hearing loss. Opportunities that will help improve follow-up services include:
 - Standardizing and adopting health information technologies to improve the exchange of clinical data between health-care providers and public health programs so providers can better coordinate and document the receipt of follow-up services.

TABLE. (Continued) Percentage of patients who are receiving selected clinical preventive services for infants, children, and adolescents — United States

- * **Source:** Lind JN, Ahluwalia IB, Perrine CG, Li R, Harrison L, Grummer-Strawn LM. Prenatal breastfeeding counseling—Pregnancy Risk Assessment Monitoring System, United States, 2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- † **Source:** Gaffney M, Eichwald J, Gaffney C, Alam S. Early hearing detection and intervention among infants—Hearing Screening and Follow-up Survey, United States, 2005–2006 and 2009–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- § **Source:** Rice CE, Van Naarden Braun K, Kogan MD, et al. Screening for developmental delays among young children—National Survey of Children’s Health, United States, 2007. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- ¶ **Source:** Raymond J, Wheeler W, Brown MJ. Lead screening and prevalence of blood lead levels in children aged 1–2 years—Child Blood Lead Surveillance System, United States, 2002–2010 and National Health and Nutrition Examination System, United States, 1999–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- ** **Source:** Kemper AR, Crews JE, Strickland B, Saaddine JB. Vision screening among children aged <6 years — Medical Expenditure Panel Survey, United States, 2009–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- †† **Source:** George MG, Tong X, Wigington C, Gillespie C, Hong Y. Hypertension screening in children and adolescents—National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, and Medical Expenditure Panel Survey, United States, 2007–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- §§ **Source:** Griffin SO, Barker LK, Wei L, Li C, Albuquerque MS, Gooch BF. Use of dental care and effective preventive services in preventing tooth decay among U.S. children and adolescents—Medical Expenditure Panel Survey, United States, 2003–2009 and National Health and Nutrition Examination Survey, United States, 2005–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
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- *** Because most 2011 NIS–Teen data were collected before ACIP recommended routine male HPV4 vaccination in October 2011, findings represent baseline data for monitoring that recommendation’s implementation.
- ††† **Source:** Jamal A, Dube SR, Babb SD, Malarcher AM. Tobacco use screening and cessation assistance during physician office visits among persons aged 11–21 years—National Ambulatory Medical Care Survey, United States, 2004–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- §§§ **Source:** Hoover KW, Leichter JS, Torrone EA, Loosier PS, Gift TL, Tao G. Chlamydia screening among females aged 15–21 years—Multiple data sources; United States, 1999–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).
- ¶¶¶ **Source:** Tyler CP, Warner L, Gavin L, Barfield W. Receipt of reproductive health services among sexually experienced persons aged 15–19 years—National Survey of Family Growth, United States, 2006–2010. In: Use of selected clinical preventive services to improve the health of infants, children, and adolescents—United States, 1999–2011. *MMWR* 2014;63(No. Suppl 2).

- Improving health insurance coverage for hearing diagnostic and follow-up services.
 - During 2007, parents of approximately 80% of children aged 10–47 months were not asked by health-care providers to complete a formal screen for developmental delays during the preceding 12 months. Opportunities to improve developmental screening include:
 - Expanding health insurance coverage and the professional workforce for developmental assessment and behavioral services.
 - Broadening support for programs to increase use of developmental monitoring, screening, referral, follow-up, and support within early childhood service systems.
 - Integrating developmental monitoring, screening, referral, and follow-up as components in electronic health records.
- During early and middle childhood, when major chronic disease/lifestyle risk factors begin to emerge, provision of lead screening, vision screening, blood pressure screening, and oral health services can prevent illness, long-term disability, and improve health and quality of life.
- During 2010, two thirds (67%) of children aged 1–2 years were not screened and reported to CDC for lead poisoning. Opportunities to increase lead screening include:
 - Developing state-specific screening plans targeting high-risk children.
 - Improving communication between state and local health departments and primary care providers on high-risk populations using geographic information system mapping.
 - During 2009–2010, according to their parents, approximately one in five (22%) children aged 5 years never had their vision checked by a doctor or other health-care provider. Opportunities to increase vision screening include:
 - Establishing evidence based guidelines for vision screening and follow-up.
 - Improving delivery of vision screening within primary care settings.
 - Developing state-based data systems for monitoring and reporting vision screening, follow-up eye care, and vision outcomes.
 - During 2009–2010, approximately one in four (24%) clinic visits for preventive care made by children and adolescents aged 3–17 years to office-based physicians and hospital outpatient departments had no documentation of blood pressure measurement. Opportunities to increase blood pressure screening include:
 - Developing state-based data systems for monitoring and reporting vision screening, follow-up eye care, and vision outcomes.

- Encouraging health-care providers to perform blood pressure checks during well-child visits and physical examinations for sports participation.
 - Providing financial incentives to providers through Stages 1 and 2 of Meaningful Use* to record blood pressure in the electronic medical record in patients aged ≥ 3 years.
 - During 2009, more than half (56%) of U.S. children and adolescents did not visit the dentist during the preceding year, and 86% of children and adolescents did not receive a dental sealant or a topical fluoride application during the preceding year. During 2005–2010, more than two thirds (69%) of persons aged 5–19 years did not have a dental sealant. Opportunities to increase use of dental care and dental preventive services include:
 - Increasing dental insurance coverage.
 - Increasing the supply of dental providers through incentives such as establishing a loan repayment program for dental faculty in institutions.
 - Increasing the number of school-based sealant programs serving high-risk schools.
- During adolescence, vaccination against HPV infections, screening for risky behaviors (e.g., tobacco use) and potential untoward consequences of these behaviors (e.g., sexually transmitted infections, unintended pregnancy), provision of interventions to help mitigate consequences, and provision of clinical reproductive health services are essential.
- During 2011, nearly half (47%) of females aged 13–17 years had not received their recommended first HPV vaccine dose, and almost two-thirds (65%) had not received ≥ 3 doses required for series completion. Among males, approximately 90% had not yet received ≥ 1 dose of HPV vaccine. However, because most 2011 NIS–Teen data were collected before the Advisory Committee on Immunization Practices recommended routine male HPV4 vaccination in October 2011, these findings represent baseline data for monitoring implementation of the recommendations. Opportunities to improve HPV vaccination rates include:
 - Decreasing client out-of-pocket costs by providing insurance coverage, or by vaccination providers participating in the Vaccine for Children program.
 - Expanding access to primary care and vaccination services by providing increased funding to community health centers.
 - Establishing additional school-based health centers.
 - Implementing reminder/recall systems at health-care providers' offices and school-based health centers.
 - During 2004–2010, approximately one in three (31%) outpatient visits made by persons aged 11–21 years to office-based physicians had no documentation of tobacco use status, and 80% of those who screened positive for tobacco use did not receive any cessation assistance including tobacco counseling and/or provision of cessation medication. Opportunities to increase tobacco use screening and brief cessation interventions include:
 - Expanding insurance coverage for screening of adolescents and ensuring comprehensive coverage of cessation treatments.
 - Implementing provider reminder systems in health-care settings.
 - Providing training to health-care providers of adolescents that includes effective intervention strategies and information on how to access referral and treatment resources.
 - During 2006–2010, 60% of sexually active females aged 15–21 years did not receive chlamydia screening during the preceding 12 months. Opportunities to increase chlamydia screening include:
 - Expanding access to health care through improved health insurance coverage.
 - Using electronic health record prompts.
 - Ensuring that providers are aware that the chlamydia screening test can easily be performed without a pelvic exam.
 - Supporting social marketing campaigns for young females.
 - During 2006–2010, approximately one fourth (24%) of sexually experienced females aged 15–19 years and more than one third (37.5%) of sexually experienced males aged 15–19 years did not receive a reproductive health service from a health-care provider during the preceding 12 months. Opportunities to improve use of reproductive health services include:
 - Increasing health-care access through expanded health insurance.
 - Establishing linkages between community-based organizations and health-care providers.
 - Adopting recommendations from the Community Guide for Preventive Services for adolescents.

Public health surveillance reports, such as this supplement, can play a key role in promoting commitment and accountability among stakeholders by reporting on successful implementation of strategies designed to improve use of clinical preventive services and monitoring improvements in service use.

*To achieve meaningful use, eligible providers and hospitals must adopt certified electronic health record technology and use it to achieve specific objectives. These objectives and measures, known as Meaningful Use, are to occur over 5 years, 2011–2016. Stage 1 is focused on data capture and sharing while stage 2 is focused on advancing clinical processes. Details are available at <http://www.healthit.gov/policy-researchers-implementers/meaningful-use>.

Health System Reforms at Federal, State, and Local Levels

All 11 reports in this supplement identified aspects of recent health-care reform initiatives that should facilitate increased use of the clinical preventive services (2–12). ACA expands insurance coverage, consumer protections, and access to care and places a greater emphasis on prevention (13). Children with insurance are more likely to receive preventive services and to have access to health-care services and consistent medical care (25). ACA contains provisions that will likely increase health insurance coverage for most legal residents of the United States, including children (13). By 2019, ACA is projected to extend health insurance coverage to 89% of the nonelderly U.S. population (26). Implementation of the law is primarily the responsibility of states and communities, health insurers, and health-care providers. For example, one provision allows children aged 19–25 years to remain on their parent's health insurance plan. According to government estimates, an additional 3.1 million young adults had health insurance coverage in 2011 as a result of the law (27). Up to 24% of children have a pre-existing condition that has placed them at risk for being denied coverage in the past. Under ACA, insurers cannot deny coverage to children or adults because of a pre-existing condition (28). This provision of the law is particularly relevant to many children with chronic conditions identified through newborn and continuous developmental screening.

As of September 23, 2010, Section 1001 of ACA requires nongrandfathered private health plans to cover, with no cost-sharing, a collection of four types of clinical preventive services. Among them were 1) recommended services of the U.S. Preventive Services Task Force graded A (strongly recommended) or B (recommended) (29); 2) vaccinations recommended by the Advisory Committee on Immunization Practices (30); 3) services adopted for infants, children, and adolescents under the Bright Futures guidelines supported by the Health Resources and Services Administration (HRSA) and the American Academy of Pediatrics (31) and those developed by the Discretionary Advisory Committee on Heritable Disorders in Newborns and Children (32); and 4) women's preventive services as provided in comprehensive guidelines supported by HRSA (33).

ACA provides strong incentives for all states to expand Medicaid eligibility to cover persons with incomes \leq 138% of the federal poverty level starting in 2014. However, a Supreme Court ruling in June 2012 held that a state will not lose federal funding for its existing Medicaid program if it chooses not to participate in the Medicaid expansion (34). As of June 2014, a total of 27 states plus the District of Columbia had indicated that they would expand Medicaid

(35). Starting in 2014, although many children are already covered for these services through traditional Medicaid's Early Periodic Screening, Diagnostic, and Treatment benefit and CHIP, under regulations adopted by the U.S. Department of Health and Human Services (HHS), coverage for the same set of preventive services as required by nongrandfathered private health plans must be covered with no cost-sharing by state alternative benefit plans for newly eligible beneficiaries of the Medicaid expansion.

ACA authorizes states and the federal government to create the Health Insurance Marketplace, to make private health insurance easier to purchase at affordable rates by small employers and individuals.[†] The Health Insurance Marketplace opened for enrollment on October 1, 2013 for coverage beginning January 1, 2014. Seventeen states and the District of Columbia intended to establish state-based marketplaces; however, only 15 states were able to do so in time for open enrollment (36). Seven states have chosen to operate state-federal partnership marketplaces, and 27 states defaulted to federal marketplaces (36). Within broad parameters, ACA provides considerable discretion in how states structure features of the available plans, which can affect the delivery of clinical preventive services (37). Each of these decisions can directly or indirectly affect use of clinical preventive services and receipt of needed treatment. HHS estimated that 76 million persons in the United States, including 18.6 million persons aged <18 years, are newly eligible for expanded preventive services coverage without cost-sharing as a result of ACA (38).

Opportunities for states and communities to increase the use of clinical preventive services also are provided by national laws supporting increased use of health information technology (HIT) and electronic health records (EHR) in hospitals and clinics (13,39). State and local governments can play important roles in the implementation of such systems by providing leadership and governance, participating in the exchange of health information, and monitoring and reporting on adoption of health information systems to the public (39).

Public Health and Clinical Care

The clinical preventive services for infants, children, and adolescents discussed in this supplement can have greater uptake and impact if they are supported and reinforced by community-based prevention, policies, and programs (40). Recognizing

[†]The Health Insurance Marketplace was set up to provide a state-based competitive insurance marketplace. The Marketplace allows eligible persons and small businesses with up to 50 employees (and increasing to 100 employees by 2016) to purchase health insurance plans that meet criteria outlined in ACA (ACA § 1311). If a state did not create a Marketplace, the federal government operates it.

the importance of broad collaboration for prevention, the National Prevention Strategy was created by ACA in 2011 (40). Integration of clinical and community preventive services is recognized as one of the four core strategies in the first National Prevention Strategy (40). The National Prevention Strategy encourages partnerships among federal, state, tribal, local, and territorial governments; business, industry, and other private sector partners; philanthropic organizations; community and faith-based organizations; and individuals to improve health through prevention (40). It is a cross-sector, integrated national strategy that identifies priorities for improving the health of the U.S. population and includes a variety of recommendations that are applicable to children's preventive services.

Use payment and reimbursement mechanisms to encourage delivery of clinical preventive services. ACA expands health insurance coverage and reduces barriers to obtaining preventive services. But as the National Prevention Strategy points out, “[m]aking preventive services free at the point of care is critical to increasing their use, but it is not sufficient” (40). Delivery of clinical preventive services increases when billing systems are in place to facilitate reimbursement and when payment systems are designed to incentivize quality and value of care. Access to preventive services can be enhanced by workforce development and payment systems that support team-based care and the use of nonphysician clinicians (e.g., nurse practitioners, physician assistants, pharmacists, and community health workers), especially in under-resourced communities. The expansion of the National Health Service Corps is intended to result in more primary care physicians in shortage areas. Medicaid payment rates to primary care physicians will be increased to 100% of the Medicare rate and fully funded by the federal government for 2 years (2013 and 2014). Expansion of community health centers under ACA is expected to increase the capacity to care for approximately seven million additional children (13,41,42). Accountable care organizations (ACO) can encourage delivery of clinical preventive services by holding provider groups accountable for improving care, reducing costs, and promoting population health (43). Accountable care communities take the ACO model one step further by holding provider groups, health systems, and public health accountable for the health of an entire community, which would require better integration of clinical and community preventive services (44).

Expand use of interoperable health information technology. HIT can be used to improve the delivery of clinical and community preventive services for infants, children, and adolescents (45). Use of EHR systems in primary care is increasing (46). The capacity to capture and report quality-of-care measures, including use of preventive services, is being built into such systems in part because of incentives offered by Medicare

(47–51). In addition to generating prompts and reminders to the providers and parents that the child is due for certain clinical preventive services (e.g., children who have not had vaccinations within the recommended interval), EHR also can provide decision support in the delivery of these services. If the child is receiving services in multiple settings, HIT can improve continuity of patient records, reduce errors, avoid omissions and duplications, and improve care coordination provided that data systems are interoperable and that safeguards are in place to protect patient confidentiality across multiple systems. At the community and public health levels, HIT can be used to increase consumer awareness (e.g., through the use of text messaging); to improve performance measurement (e.g., tracking the percentage of newborns who have been screened for hearing before hospital discharge); and to support collaborative quality improvement in the delivery of preventive services for infants, children, and adolescents. Increasing use of electronic health information systems and electronic data exchange systems offers the possibility of collecting and reporting on use of clinical preventive services at the national, state, and local levels (39,46–51).

Support implementation of community-based preventive services and enhance linkages with clinical care. Clinical and community preventive efforts should be mutually reinforcing (40). Persons should receive appropriate preventive care in clinical settings (e.g., a clinician providing breastfeeding counseling and support) and also be supported by community resources at home (e.g., lactation support by home visiting nurse or community health worker), in the workplace (e.g., availability of a lactation room), and in the community (e.g., lactation support group). For many school-aged children and adolescents, schools provide a convenient point-of-care for delivery of clinical preventive services.

Reduce barriers to accessing clinical and community preventive services, especially among populations at greatest risk. Many more infants, children, and adolescents will receive needed preventive services if logistical, financial, cultural, and health literacy barriers to care are removed (40). Community programs can play a role in addressing these barriers, including transportation, child care, and patient navigation issues.

Enhance coordination and integration of clinical, behavioral, and complementary health strategies. According to the National Prevention Strategy (40), integrated health care describes a coordinated system in which health-care professionals are educated about each other's work and collaborate with one another and with their patients to achieve optimal patient well-being. Integrated health care can be delivered through a variety of care coordination models, including medical homes, community health teams, and home visits. Authorized by ACA, the Maternal, Infant, and Early Childhood Home Visiting

Program is designed to improve service coordination and outcomes for families residing in at-risk communities (52). Through the home visiting program, nurses, social workers, or other trained home visitors meet with at-risk families in their homes, evaluate their circumstances, and connect them to services such as health care, developmental services for children, early education, parenting skills, child abuse prevention, and nutrition education or assistance. The home visiting program offers another example of how community preventive services can reinforce clinical preventive services to improve outcomes for infants, children, and adolescents.

Improving Public Health Surveillance

Ideally, public health surveillance systems would have the capacity to track, in a timely, comprehensive, and accurate manner, the effects of numerous efforts that might influence use of clinical preventive services that can improve infant, child, and adolescent health. These efforts include implementation of ACA and electronic health information systems as well as actions by public health and other stakeholders. These systems would have the ability to characterize infants, children, and adolescents who are eligible for specific services and those who do or do not receive them, examine the effects of laws and other interventions, and assess resulting health outcomes at both the individual and population levels. The ability of current resources and public health surveillance systems to enable examination of such relationships is limited. However, surveillance reports such as those in this supplement can be helpful by highlighting underuse of the services in infants, children, and adolescents, identifying trends that might be due, in part, to various interventions currently underway, and illuminating disparities. The reports in this supplement also highlight several gaps in the types of health surveillance information needed to guide efforts to increase use of important clinical preventive services. For example, as noted in the Rationale for this supplement, several preventive services of interest in infants, children, and adolescents could not be addressed because of a lack of available information (1). Also, enhancement of survey tools (e.g., additional questions added to national and state-based surveys) as mentioned in several reports in this supplement would help determine the use of certain clinical preventive services (6,11). Although almost all of the reports in this supplement present national data, most of the surveys cannot provide data that are necessary to monitor progress at the state and local levels. State and local surveys, such as the Youth Risk Behavior Surveillance System, might be able to capture more of the kind of information included in this supplement. This supplement challenges health and public

health professionals to identify resources that can be used to provide information at the state and local levels.

Initiatives are underway to improve the ability of health-care and public health agencies to share de-identified information from EHR systems to improve population health (39,47–50). Although challenges exist in the development of these electronic record and information sharing systems (47,51), these systems should contribute to monitoring and improving use of the preventive services noted in this report. De-identified information from Medicare and Medicaid databases also might provide new opportunities for this type of surveillance (53). Additional sources of information for surveillance and an increased ability to link information from various sources can help provide a more complete and integrated perspective on steps that stakeholders need to take to improve use of these services.

Future Reports on Clinical Preventive Services

Reports updating the use of selected clinical preventive services to improve the health of U.S. infants, children, and adolescents might include additional indicators for clinical preventive services that are known to have important health benefits but were not included in this supplement for various reasons, primarily lack of adequate surveillance information (1). Such reports might include screening and counseling for obesity, alcohol consumption, and mental health, services that can benefit large segments of the child and adolescent population. As public health surveillance information becomes more available and as interventions to improve the use of clinical preventives services are implemented by public health and other stakeholders, future reports should be useful for monitoring and evaluating progress in achieving the goals of clinical preventive services.

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