

**Board of Scientific Counselors
National Center for Health Statistics**

**Program Review
National Immunization Survey (NIS) and
State and Local Area Integrated Telephone Survey (SLAITS)**

November 27-28, 2007

Background Materials: NIS

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1. Origins of the NIS

Overview of the U.S. Immunization Program

In 1962, the Vaccination Assistance Act established the Section 317 grant program to support state immunization programs¹. In 1976 and 1977, there was a major resurgence of measles, with the majority of cases in school-aged children. This led to the 1977 Childhood Immunization Initiative, which focused on enactment of school immunization laws. After another major resurgence of measles in 1989-1991, the 1993 Childhood Immunization Initiative (CII) was undertaken, establishing the goal of increasing vaccination coverage levels among children aged 2 years to greater than 90% by 1996 for the most critical doses of each vaccine routinely recommended for children. The CII sought to improve delivery of vaccines to children, reduce the cost of vaccines, make vaccines more accessible, increase awareness of the importance of immunizations, improve the science of vaccine development, monitor immunization coverage and report outbreaks of disease. The Vaccines for Children (VFC) was established, an entitlement program providing vaccine free to children with Medicaid or no health insurance, to children receiving care at federally qualified health centers who have private insurance that does not cover cost of vaccination, and to American Indian and Alaskan Native children. The Omnibus Budget Reconciliation Act of 1993 (42 U.S.C. 1296s) conferred an operational role on the Advisory Committee on Immunization Practices (ACIP) to provide advice which will assist the Department and the Nation in reducing the incidence of vaccine preventable diseases and to increase the safe usage of vaccines and related biological products. The ACIP makes recommendations regarding the most appropriate application of antigens and related agents (e.g., vaccines, antisera, immune globulins) for effective vaccine preventable disease control in the civilian population and to establish a list of vaccines for administration to children eligible for the VFC program, along with schedules regarding the appropriate periodicity, dosage, and contraindications to pediatric vaccines.

Currently, there are 15 vaccines for 16 vaccine preventable diseases recommended for children and adolescents in the U.S. The Federal government spends approximately \$3.4 billion per year on national and state immunization programs, including more than \$2.5 billion through the VFC program to purchase vaccines to be given to children at risk of under-vaccination due to inability to pay. The current routine childhood immunization schedule results in substantial cost savings, estimated for an annual birth cohort at \$9.9 billion in direct costs and \$43.3 billion from a societal perspective.²

Vaccine Coverage Assessment

During 1957-1985, vaccination coverage in the U.S. was monitored based on parental recall by the U.S. Immunization Survey, a component of the Current Population Survey.³ This was dropped after 1985 because of concerns about the validity of parental report of childhood vaccinations and budget cuts. The Centers for Disease Control and Prevention (CDC) supported retrospective school surveys during 1985-1991. The 1993 CII resulted in funding for the National Immunization Survey (NIS), a two phase survey consisting of a random-digit-dialed survey of households, and a mailed survey to providers identified during the household telephone interview. The NIS has been conducted annually since 1994, providing estimates of vaccination coverage for children aged 19-35 months for each state and selected local areas. During 1994-1999, the National Health Interview Survey (NHIS) also included questions on vaccinations for children with a provider record check (NIPRCS). This provided national provider-reported data used in the NIS weighting adjustments for households without telephones. NIPRCS was discontinued to allow funding of pilot projects to assess adolescent vaccination coverage and other projects, and because NIS began to use a weighting adjustment for phoneless households based on NIS respondents with interruptions in their landline telephone service.

¹ Orenstein WA. The role of measles elimination in development of a National Immunization Program. *The Pediatrics Infectious Disease Journal* 2006;25:1093-1101.

² Zhou F, Santoli J, Messonier ML, et al. Economic evaluation of the 7-vaccine routine childhood immunization schedule in the United States, 2001. *Arch Pediatr Adolesc Med* 2005;159:1136-1144.

³ Simpson DM, Ezzati-Rice TM, Zell ER. Forty years and four surveys: how does our measuring measure up? *AJPM* 2001;20:6-14.

The current budget for vaccination assessment is approximately \$22 million, less than 1% of the federal investment in immunization programs. These funds are used for vaccination assessment for vaccines recommended by the ACIP in children, adolescents and adults. The NIS provides assessment of vaccinations during the first two years of life, and during adolescence. Adult vaccination coverage is assessed by vaccination questions added to the Behavioral Risk Factor Surveillance System (BRFSS) and the NHIS, and by periodic adult vaccination surveys to provide more timely information on new vaccines and more detailed knowledge and attitude questions on old and new vaccines.

2. Purpose of Vaccination Assessment

Aligned with the 1993 CII are the Healthy People 2000 and 2010 vaccine coverage objectives, which have served as a foundation for surveillance, research, improving vaccine delivery systems, and establishing effective community partnerships. Continuous monitoring is necessary to ensure that each annual birth cohort of over four million children is fully vaccinated per ACIP recommendations by their 2nd birthday. Monitoring is also needed for adolescents. Recently, three vaccines were routinely recommended at ages 11-12 years, including human papillomavirus (HPV) vaccine, meningococcal vaccine, and Tdap, a tetanus booster including antigens to protect against pertussis.

The overarching goal of CDC vaccination assessment is to facilitate program improvement and behavior change leading to increased vaccination levels, thus reducing the health and societal impact of vaccine preventable diseases.

Specific objectives:

- accountability to maximize value of public funds spend on immunization
- evaluate effectiveness of immunization grant programs over time
- help with allocation of VFC program resources
- monitor progress toward national *Healthy People* objectives
- build and maintain support for national and state immunization programs
- identify subgroups at higher risk of vaccine preventable diseases
- identify facilitators for and barriers to vaccination, to improve interventions
- evaluate implementation of ACIP recommendations
- assess differential impact of vaccine shortages
- evaluate uptake of new vaccines
- assist in evaluating health and societal impact of vaccination
 - proxy for immunity
 - ecologic analysis of disease trends
 - vaccine effectiveness studies
 - estimation of morbidity and mortality prevented by vaccination
 - vaccine safety studies
 - cost effectiveness studies
- emergency preparedness (e.g., monitoring influenza vaccination during a pandemic).

3. Stakeholders

One of the main purposes of vaccination assessment is accountability, the responsibility of the federal government to maximize value of public funds spent on immunization. In addition, the data should help CDC, the states and other grantee programs take actions to improve coverage levels in accordance with vaccine recommendations. The information should be used to target programmatic interventions to those areas most in need, to measure improvements based on those interventions, and help immunization programs build support at the state level for improving performance and reward areas that have invested in their immunization efforts.

Key federal stakeholders in the NIS include various organizations within the CDC with responsibility related to vaccine preventable diseases, Department of Health and Human Services, Centers for Medicare and Medicaid Services (CMS), Health Resources and Services Administration (WIC programs, federally qualified health centers), Office of Management and Budget (OMB) (Section 317 and VFC appropriations), and Congress. Key state and local stakeholders include the state and local immunization programs, and affiliated organizations such as the Association of Immunization Managers (AIM), Association of State and Territorial Health Officers (ASTHO), Council of State and Territorial Epidemiologists (CSTE), and the National Association of City and County Health Officers (NACCHO). CDC also partners with provider, health insurer and community organizations interested in immunization programs.

4. Resources and Organization

Funding for the NIS is obtained through the Public Health Service Evaluation Transfer Fund (Section 241 of the Public Health Service Act), the VFC program, and CDC National Center for Immunization and Respiratory Diseases (NCIRD) program funds.

Vaccination assessment resources for fiscal year 2007 totaled \$23.3m and included:

- \$12.8m PHS Evaluation
- \$7.7m Vaccines for Children Program for NIS
- \$1.4m Section 317 grant funding
 - NIS oversampling in areas chosen by state
- \$ 0.9m NCIRD, Immunization Services Division (ISD) research funds
- \$ 0.6m federal appropriations for influenza pandemic planning

Fiscal year 2007 funds were expended as follows:

- \$20.5m NIS contract (NORC)
 - \$12.2m core NIS
 - \$ 2.2m NIS-Teen
 - \$ 2.7m modules (Adult, SES, Concerns)
 - \$ 1.5m operational/methods research
 - \$ 1.4m NIS oversampling in selected areas
 - \$ 0.6m influenza pandemic survey module
- \$ 1.1m Inter Agency Agreements with NCHS
 - Support of NHIS immunization questions
 - NCHS staff support of NIS (~1.5 fte)
- \$ 1.7m other assessment activities

The NIS is conducted under contract with the National Opinion Research Center (NORC) at the University of Chicago. NCIRD and NCHS oversee the technical and administrative aspects of the project. NORC assists with the design and operations, data collection and processing, file production, and qualitative assessments. The Assessment Branch, ISD/NCIRD, is responsible for managing the NIS and other vaccination assessment activities. The Branch has 17 full time staff, including 14 civil service positions, one Commissioned Corps medical officer, and three contractors. Most staff are epidemiologists, statisticians or health scientists. Approximately 9 of 17 full-time-equivalents are devoted to the NIS; remaining staff are responsible for adult vaccination assessment, technical assistance to state and local immunization programs in assessing vaccination in schools, child care facilities and other settings, and collaborating in face-to-face immunization surveys in U.S.-affiliated jurisdictions. NCHS staff serve as co-project officer for the NORC contract, responsible for the SLAITS component. NCHS staff also manage submissions to the NCHS IRB for the annual NIS renewal and protocol amendments, provide advice and recommendations on management of the NORC contract and NIS operations, participate in methods research, and handle public use file development and testing.

5. NIS Methods

The NIS will be described in terms of key attributes for designing a vaccination coverage assessment system, including the target population, sampling method, vaccines assessed, auxiliary data collected, geographic specificity, periodicity of data collection and reporting, timeliness, comparability across areas and over time, representativeness, and accuracy. The statistical methods of the NIS have been described in detail.⁴

Target population

The core NIS targets non-institutionalized children aged 19-35 months at the time of the telephone interview. Since the NIS is conducted based on quarterly samples, a calendar year of data includes children born over three annual birth cohorts (e.g., 2006 data included children born January 2003-June 2005). Approximately 4% of households in the U.S. have an eligible child aged 19-35 months, and this varies greatly by area. Thus the NIS screens a substantial number of households in order to identify those with young children.

In the 4th quarters of 2006 and 2007, a national sample of adolescents aged 13-17 was included (NIS-Teen). The NIS-Teen will be expanded in 2008 to a calendar year of data collection to allow estimates for 56 areas (states and six urban areas receiving Section 317 grant funding).

Sampling method

The NIS (and NIS-Teen) are conducted as stratified, two phase surveys, with the first phase a list-assisted, random-digit-dialing survey to identify households with age-eligible children. The second phase is a mailed survey to providers identified during the telephone interview to collect provider-reported vaccination histories. A critical objective for the telephone interview is to obtain information about providers who have vaccinated the children, and consent from the parent or guardian to contact the provider(s).

Vaccines assessed

All ACIP recommended vaccines that children should have received by 19 months of age are included in the core NIS. The NIS-Teen collects information about vaccines routinely recommended by ACIP at 11-12 years of age, including to “catch-up” with vaccinations missed during earlier childhood.

Auxiliary data collected

During the household interview with a parent or guardian most knowledgeable about the eligible child, questions asked include: race/ethnicity of mother and child; mother’s age, education and marital status; family income; health insurance status; WIC participation; availability of a shot card; breastfeeding; and number of persons in the family. The provider survey form includes questions about the number of physicians at the practice, type of facility, whether the provider participates in the VFC program, and whether the provider obtained information for the child, or provides vaccination data for the child to an Immunization Information System (IIS) or registry.

To collect additional information relevant to the immunization program, supplemental modules are periodically added to the end of the core NIS survey for a subsample of NIS respondents. Past modules have included: Insurance Status (2001-02; part of core NIS starting 2006); Day Care and Breast Feeding (2001-02; breastfeeding part of core NIS starting 2003); Attitudes and Beliefs (2001-02); Vaccine Safety (2003-04); Vaccine Shortage (2003-04); and Childhood Influenza (2004). A Socioeconomic Status (SES) module is planned for the first half of 2008 to assess barriers to immunization, and factors associated with racial/ethnic and income-related coverage disparities. Selected key questions from this module may be considered for the NIS core. A Parental Concerns module is planned for the last half of 2008, to provide an early warning system for parental concerns about vaccination. It will include questions on parental attitudes about safety and effectiveness of vaccination, quality of

⁴ Smith PJ, Hoaglin DC, Battaglia MP, et al. Statistical methodology of the National Immunization Survey, 1994-2002. National Center for Health Statistics. Vital Health Stat 2(138). 2005.

interactions with providers about vaccination, and parental delay or refusal of vaccines, including which vaccines were delayed or refused, and why.

Geographic specificity

The NIS provides precise national estimates of vaccine coverage, and estimates at state and selected local areas with reasonable precision (e.g., 95% confidence halfwidths of $\pm 4\text{-}7\%$). The NIS was conducted as independent surveys in 78 areas from 1994-2004, including the 50 states, the six urban areas receiving Section 317 grant funding (Bexar County, TX; Chicago, IL; District of Columbia; Houston, TX; New York City, NY; Philadelphia County, PA) and 22 other urban areas. During 2005 and 2006, CDC worked with NACCHO to identify ~5 new areas during each of those years to oversample, while an equivalent number of the original non-grantee urban areas were not oversampled to balance cost. Starting in 2007, the NIS conducts independent surveys in the 50 states, the six urban area grantees, and other city or county areas selected by states and funded using states' Section 317 grant funds (average cost ~\$200,000 per area oversampled). Eight areas were chosen by states for NIS oversampling in 2007. The shift from NIS oversampling in the 22 non-grantee areas allowed funding of the NIS-Teen survey and other methods research, and provides states with flexibility in choice of selected areas to be oversampled.

Periodicity of data collection and reporting

The NIS is conducted continuously based on quarterly samples. Analytic data sets are delivered to CDC by NORC twice a year: in December, based on data from the last half of the prior year combined with data from the 1st half of the current year, and in June based on data from the prior calendar year. December data are reported online in standard tables. Data dissemination focuses on the calendar year data reported each June, which includes MMWR articles, online standard tables, a public use file, and articles for peer-reviewed scientific journals.

Timeliness (vaccination to data availability)

Timeliness is a key attribute affecting usefulness of the survey data for evaluating program success. Here, we define timeliness as the average number of months from *vaccination* to availability of calendar year data. The earliest possible vaccination is a dose of hepatitis B vaccine given within 12 hours of birth. Timeliness for the hepatitis B birth dose is 38 months (25-52 months). Components of delay include age when surveyed (e.g., 19 months in December or 34 months in January), and the six month lag from end of calendar year data collection until data delivery. Timeliness for other vaccines are: 32 months for 3rd dose of Rotavirus vaccine (range 19-46m); 26 months for MMR and varicella vaccines (range 13-40m); 19 months for 4th dose of DTaP (range 6-33m); and 17 months from end of the influenza vaccination period (January) for influenza vaccine.

Comparability across areas and over time

With accountability as one of the key purposes of the NIS, having comparable estimates across states and local areas sampled, and within areas over time, is crucial. The NIS accomplishes this by using the same contractor and methods in all sampling areas. Sample sizes are chosen to achieve an effective sample size of 180 children with adequate provider data per area.

Representativeness

A key attribute of any survey is representativeness – is there minimal bias in estimates as compared to the true results for the target population? The NIS strives to minimize potential bias by maximizing response rates and weighting adjustments. Response rates are maximized through maintenance of a highly trained and monitored interviewer work force, mailing of advance letters if an address can be matched to a sampled telephone number, multiple call-back attempts to gain cooperation, keeping the length of the survey as short as possible (average 20 minutes), maintenance of a toll-free number and website to facilitate participation, carefully scripted answering machine and voice mail messages, and the offering of \$15 as a token of appreciation for selected respondents (e.g., those who acknowledge young children in the household, but have not given birth date needed to determine eligibility, have started but not completed the interview, or completed the interview but have not given consent to

contact their child's vaccination providers). The household questionnaire is available in a Spanish version of the CATI system for administration by bilingual staff interviewers (9% of 2005 interviews), and use of Language Line Services (187 interviews, or 0.67% of all interviews in 2005). Cooperation from providers is facilitated with multiple mailings and telephone follow-up with providers who have not responded to the mail portion of the survey.

Data are weighted to account for the initial probability of selection of a household, households with multiple telephone numbers, unit non-response, households without landline telephones (using NIS respondents with interruption in telephone service during the previous 12 months to represent households with landlines), and to match population control totals by mother's education, and child's race/ethnicity, gender and age. Information collected during the telephone interview for children for whom adequate provider data is not collected (parent did not give consent to contact providers, provider did not respond, or provider response deemed inadequate) is used in the weighting adjustment (to estimate response propensities and formation of weighting classes). Residual bias may remain after weighting adjustments.

Accuracy

Because parental report of childhood vaccination was determined in multiple studies to be unreliable, the NIS initial design incorporated collection of vaccination histories from providers. All NIS estimates are based on children with adequate provider data reported. Provider data may not always be complete, particularly if the child had more than one provider and not all of those providers are identified by the parent or respond to the survey if identified.

6. Information Dissemination

NIS findings are disseminated through:

- annual MMWR articles, including pre-publication briefings with selected grantees
- detailed tables posted online twice yearly (<http://www.cdc.gov/vaccines/stats-surv/imz-coverage.htm#nis>)
 - Q3-4 2005 + Q1-2 2006 data ~ Jan. 2007
 - Q1-4 2006 data ~ summer 2007
- public use file available annually (<http://www.cdc.gov/nis/reports.htm>)
- in-house analysis
 - 13 NIS papers published in 2006
- ad hoc requests from states, CDC, other
- inclusion in *Healthy People 2010* reports, reports to Congress and OMB, Agency for Healthcare Research and Quality racial disparities report, and America's Children report.

NIS results generate press interest every year and are widely cited by other organizations in publications and on websites. An online data query system will be developed via the Census Data Ferret program to facilitate access to cross-tabulations, mapping and trend graphs.

NIS data have been used in a variety of ways, including:

- monitoring state immunization program improvements
- management of the Vaccines for Children (VFC) entitlement program (health insurance)
- monitoring *Healthy People 2010* objectives
- uptake of new vaccines
- factors associated with coverage
- racial/ethnic and socioeconomic disparities
- parental vaccine safety concerns
- quality performance measures
 - timeliness, age-appropriate & validly-spaced doses
- use of combination vaccines
- county-level coverage estimation

- coverage trends by birth cohort
- cost-effectiveness analysis
- vaccine-effectiveness studies

Appendix A includes a selected bibliography of recent NIS-related articles.

7. Challenges

Two major challenges currently facing the NIS and SLAITS are declining response rates and increasing non-coverage of the sample frame as households drop their landline telephone service and rely solely on cell phones. These challenges are not unique to the NIS and are shared by other telephone surveys in the public (e.g., BRFSS) and private survey sectors. Both of these challenges can potentially increase the cost of the survey. Lower response rates mean a larger sample of initial phone numbers must be drawn and worked through. In 2005, 4,465,261 telephone numbers were sampled in order to identify 1,085,040 households, successfully screen 1,006,435 households, identify 31,909 eligible households, complete interviews for 27,627 children, and yield a final sample of 17,448 children with adequate provider data. Increasing non-coverage of the sample frame will require supplemental sample frames to evaluate potential non-representativeness. Eventually, sample frames that include non-landline households will be needed to supplement or replace the landline sample frame.

Response Rates

NIS response rates are reported separately for the two survey phases. The final CASRO household response rate is the product of the resolution rate (proportion of telephone numbers resolved as either a household or non-household), screener rate (proportion of telephone numbers resolved as a household that are successfully screened for presence of an age-eligible child), and the interview rate (proportion of households with age-eligible children identified that complete the interview). The Household Rates figure in Appendix B shows the trend in these rates since the beginning of the NIS in 1994. Rates have generally declined from 1994 to 2006, the most recent year with finalized response rate data: from 94.6% to 83.3% for the resolution rate, from 96.2% to 90.5% for the screener rate, from 95.4% to 85.6% for the interview rate, and from 86.8% to 64.5% for the CASRO overall household response rate. In addition the eligibility rate among screened households has declined from 4.1% in 1994 to 3.3% in 2006. The actual percent of households with 19-35 month old children has been estimated at 4-5% based on the Current Population Survey. It is suspected that some NIS respondents opt out of the survey during the screening by failing to identify they have age-eligible children. The resolution and screening rates may also be lower for eligible households than ineligible households. It is also possible that some of the decline in observed eligibility rate among screened households results from an actual decline in prevalence of households with 19-35 month old children, particularly among households with landline telephones.

The Child Rates figure in Appendix B shows the trends in response rates related to the provider phase of the survey. The consent rate (proportion of children with completed household interviews for whom consent is given to contact the providers) remained relatively stable at 84.0-87.6% during 1995-2004, but declined during the first two years of the NIS under the new contractor, NORC (78.5% in 2005, 81.0% in 2006). The unconditional adequacy rate (proportion of children with completed interview for whom adequate provider data is obtained) has remained relatively stable in recent years, ranging from 65-70%. Provider response to the survey has been good over the years, with a mail return rate of 86% or higher since 1998. In 2006, the provider return rate was 94.4%, the highest rate since 2000.

Coverage of Target Population

Based on data from the NHIS (see Appendix C), the percentage of children aged <18 years living in households with only wireless service increased from 2.9% in the 1st half of 2003 to 11.6% in the last half of 2006. The percentage of children living in households with no phone service has remained relatively stable (2.3% in the last half of 2006). Based on data from the 2005 NHIS, a larger proportion of children aged 1-3 years (similar to NIS-eligible age) lived in wireless only or phoneless households: wireless only 9.7% for 1-3 year olds vs. 5.8-7.6% for

all children; phoneless 3.4% for 1-3 year olds vs. 1.5-1.8% for all children (Khare et al., JSM 2006). The proportion of children aged 1-3 years in households with landlines was lower than the national average (87%) in some subpopulations, including Hispanics (83%), non-Hispanic blacks (82%), no private insurance (78%), living below the poverty threshold (75%), and living in a household with only two persons (e.g., one parent and child) (65%).

To assess potential bias due to non-coverage, NHIS respondents can be compared by telephone status. Based on the 2005 NHIS, there is little evidence of bias due to non-coverage of non-landline households (Khare et al., JSM 2006). However, this conclusion is based on proxy measures such as parental reported receipt of influenza vaccination, number of reported provider visits in the past 12 months, and vaccination status predicted from sociodemographic variables, and does not provide a direct comparison of provider-reported vaccination status among children in landline vs. wireless only and phoneless households. Further monitoring of potential bias due to non-coverage of non-landline households is needed using more recent NHIS data, expanding to assess the NIS-Teen, and evaluating the degree to which current non-coverage adjustments based on NIS respondents with landline interruptions adequately adjust for the non-coverage. Further research is also needed to benchmark NIS indicators such as type of health insurance, poverty level, household size, and parental report of influenza vaccination to other surveys (e.g., NHIS) to assess combined effects of non-response and non-coverage. Incorporating income level into weighting adjustments should also be explored.

Methods Research

The NIS has a rich history of methods research. Projects initiated during the past two years and potential future projects are listed below, organized by topic area. A bibliography of recent methods-related research conducted in collaboration with NORC, NCHS and NCIRD is presented in Appendix D.

Bias from non-coverage of the sample frame and non-response

- NHIS analysis of potential bias from non-coverage of non-landline households
- Impact of incentives on representativeness
- Impact of refusal conversion on representativeness
- Ecologic analysis of nonresponse bias resulting from non-resolution of telephone interviews, eligibility screener nonresponse, and interview nonresponse
- Use of Immunization Information Systems (IIS) as a dual sample frame (currently underway in two states)
 - Independent samples of children from each of two IIS will be selected and the usual NIS interview and provider record check conducted. Sampled children from the IIS who live in a wireless only or phoneless household will also be included. Nonresponse bias can be assessed using vaccination histories in the IIS for children.
- Development of a simulation model to simultaneously assess multiple sources of bias at each survey stage

More cost-efficient landline sample frame

- Impact of moving to 2+ or greater phone bank sampling
- Oversampling of listed telephone numbers
- Use of age-targeted phone list sample frames
- Use of Immunization Information Systems (IIS) as a dual sample frame
 - IIS can easily identify age-eligible children, so use of an IIS frame may reduce the amount of landline sample needed.

Alternative sample frames that include non-landline populations

- Use of IIS as a sample frame (this project will provide an initial assessment of the feasibility of supplementing or replacing landline sample frames with IIS sample frames).
- Cell phone sample frames (several cycles of research by NORC have been conducted to pilot an abbreviated NIS interview with eligible households; preliminary findings indicate lower resolution and screener rates for cell phone samples, resulting in much higher costs than landline samples).

- Further research is being considered for 2008 to obtain a national sample of children in wireless only households to evaluate potential non-coverage bias, and to further investigate the best approaches to maximizing response rates.
- NHIS sample frame (includes children in wireless only and phoneless households, so follow-back to providers to obtain vaccination histories would allow national estimation of bias in NIS)
- Potential future evaluations:
 - American Community Survey
 - BRFSS (when it incorporates an address-based sampling frame)
 - NIS-specific address-based sampling frame
 - Use of school-based sampling frame for NIS-Teen

Improving Response Rates and Survey Efficiency

- Questionnaire changes to improve interview completion and provider consent rates
- Restructuring the advance letter to improve resolution, screener, interview completion and consent rates
- Cost-benefit analysis of various calling rules to increase efficiency and response rates
- Experimentation with alternative methods to break down the answering machine barrier
- Experimenting with a shorter interview
- Experimenting with caller ID to improve cooperation
- Improving quality on interviewer monitoring
- Pre-screening telephone numbers to identify nonresidential lines
- Optimizing day and time of first dials
- Best follow-up protocols for provider non-respondents
- Potential future research:
 - Further experiments with incentives (e.g., delay full payment, increasing incentive amount, sending a deactivated bank card in lieu of cash, expansion of incentives to additional respondent groups.
 - Expand approaches used to contact respondents and complete screeners and interviews (e.g., mailing questionnaires, web response options)
 - “Bank” children too young to be eligible at time of screening for future follow-up when they reach 19-35 months (could also collect provider data for younger children for more timely assessment of vaccines recommended during the first 6 months of life, e.g. hepatitis B birth dose, rotavirus vaccine).
 - Changes to the screener and household questionnaire
 - Respondent customization, e.g., mention respondent’s state in advance letter, customized refusal conversion letter)

Improving Weighting Adjustments

- More stable estimates of the area-specific proportion of NIS children in landline households
- Post-Katrina New Orleans weighting adjustments
- Calibration of sample using data on income to compensate for drift over time in sample to more affluent respondents due to non-coverage and nonresponse

Improving Accuracy of Data

- Redesign of the provider survey form to limit errors in recording of hepatitis B birth dose
- Matching of NIS sample to 12 state/local IIS to compare vaccination histories (will help determine if IIS vaccination histories are sufficiently complete, and evaluate completeness of hepatitis B birth dose reporting by NIS providers)

Future Design of the NIS

The NIS is at a critical juncture given the increasing proportion of young children in wireless only households. The potential bias in the landline sample resulting from non-coverage of non-landline households can be determined as a function of the difference in vaccine coverage estimates between children in landline vs. non-landline households, and the proportion of children in non-landline households. This relationship is shown graphically in Appendix E.

For example, if vaccination coverage were 6 percentage points higher in landline vs. non-landline populations, and 15% of children live in non-landline households, bias due to non-coverage would be 1%. A first step is to evaluate where we are on the x-axis of this figure, i.e., we need to estimate the vaccination coverage in a representative sample of children in non-landline households. For example, this could be obtained by reinstating the NHIS NIPRCS. It will be expensive to collect this information from cell phone samples, and lower response rates may adversely affect representativeness. Over time, it will be necessary to supplement or replace the landline frame with another frame that includes non-landline households. For example, a tri-frame design could be used, with landline, cell phone, and address-based frames combined. Alternative frames include Immunization Information Systems (IIS) which in most states are populated by birth records, piggybacking on future BRFSS address-based frame, piggybacking on the American Community Survey, using a school-based sampling frame (for adolescents), and provider-based sampling frames. The challenge is to develop short and long term strategies for evaluating and choosing among these various options, while maintaining a credible survey that will provide the information needed to monitor the U.S. Immunization Program.

8. Objectives of NCHS BSC Program Review

Strategic Planning Efforts

Strategic planning for vaccination assessment is a high priority for the National Center for Immunization and Respiratory Diseases (NCIRD). The outcome of internal and external reviews will ultimately lead to vaccination assessment data that prompt our national and state programs to continue effective actions. We have paid especially close attention in our assessment program to those vaccines that the ACIP votes to place in the VFC program for eligible children and adolescents for routine vaccination. In addition, ACIP makes recommendations for other vaccines, other age groups, sub-populations—such as medically high-risk persons, and specific venues—such as health care settings. Yet, all the ACIP recommendations are not currently coupled with strong assessment strategies to measure vaccination coverage or disease impact. Due to the breadth of the vaccination enterprise and limited resources for assessment, we must prioritize our work. Vaccinating young children and assessing coverage among 2-year-olds is the bedrock of our program. If we want similarly strong vaccination programs for adolescents and adults, then we must carefully plan the best ways to measure coverage in those populations. To this end, an external panel was convened in April 2007 to provide recommendations for prioritization of vaccination assessment and address the question, “What should we be assessing?” Coupled with this external review was a series of meetings of stakeholders within the CDC. Among the recommendations from these external and internal deliberations were several high-priority activities related to the NIS:

- Maintain the annual NIS in 56 grantee areas with provider record check
- Need grantee-specific coverage estimates for adolescents
- Continue NIS methods research
- Develop short and long term strategic plan for the role of IIS in coverage assessment.

The final report from the external panel will be circulated widely to stakeholders and further comment solicited. Another brief review was conducted in October 2007 by the NCIRD subcommittee of the Coordinating Center for Infectious Diseases Board of Scientific Counselors. Recommendations included:

- Quickly expand NIS to survey infants (ages <12 months) and adolescents for state-level estimates
- Develop a mechanism to better assess immunization coverage among adults
- Develop IIS to (1) serve as a sampling frame for current NIS approaches and (2) to provide coverage data themselves
- Encourage links to electronic medical records (EMRs) to capture existing medical data and maximize the utility of IIS

Proposed Questions for the NCHS BSC Review Panel

Prior reviews and planning have focused on the breadth of vaccination assessment activities across the lifespan. Strategic decisions are needed within the next year to set the direction of the NIS, the cornerstone of our assessment system. The current contract with NORC is in its third year, with two optional years; a new contract must be in place by fall 2009, so the scope of work must be developed by fall 2008. This scope of work must outline the specific sampling frames to be used, or offer a menu of possible frames. Feedback from the NCHS BSC review panel on the following questions would be useful in guiding next steps:

- *What could be done to improve the validity and efficiency of the NIS?*
- *How should we deal with increasing prevalence of households with only cell phones?*
- *What alternative sampling designs should be considered?*
- *What steps and processes should be undertaken to aid decisions about the future direction of the NIS sampling design?*

Appendix A: Selected NIS-Related Bibliography

2007 research articles

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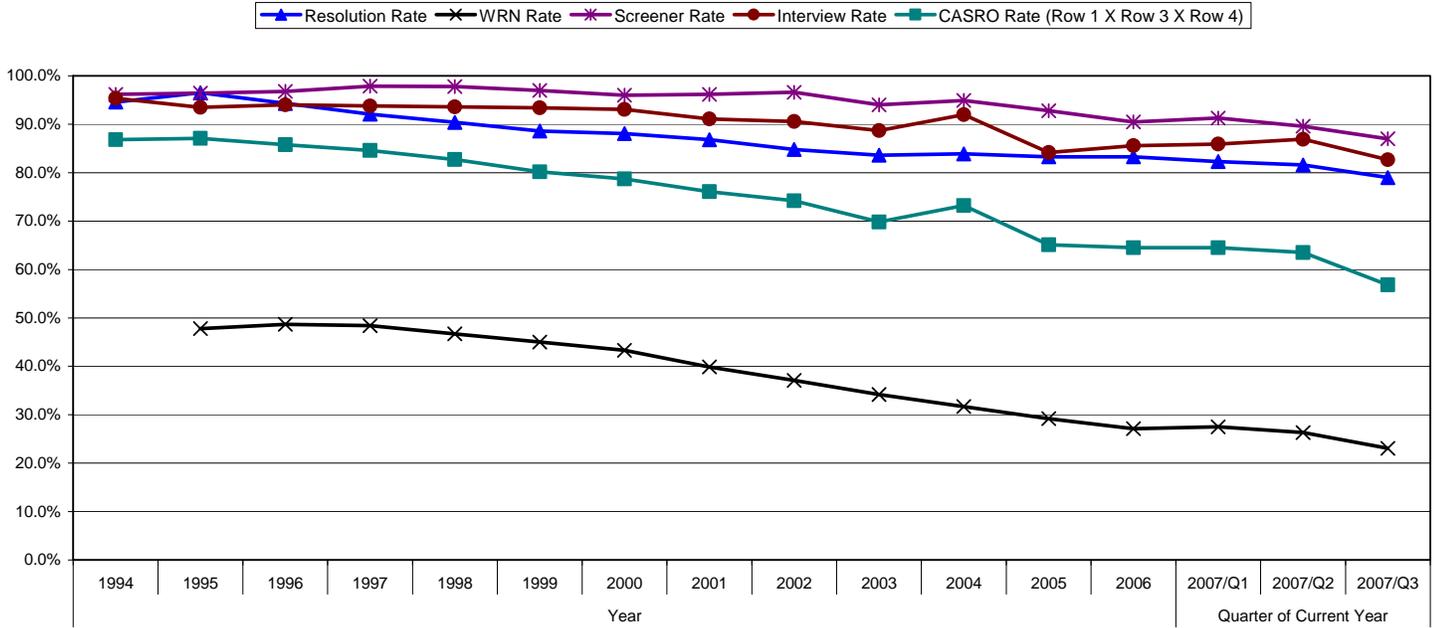
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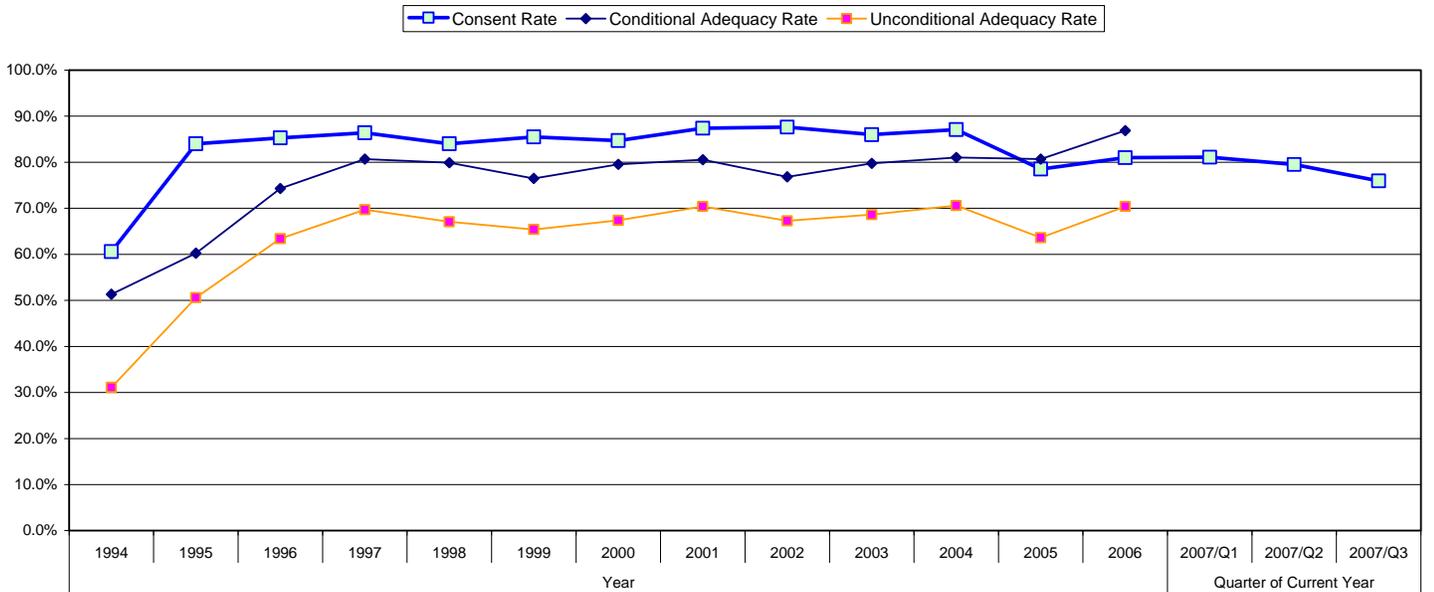
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Appendix B: NIS Response Rates
 Note 2007 response rates are not complete

Household Rates
 (data through 9/16/2007)

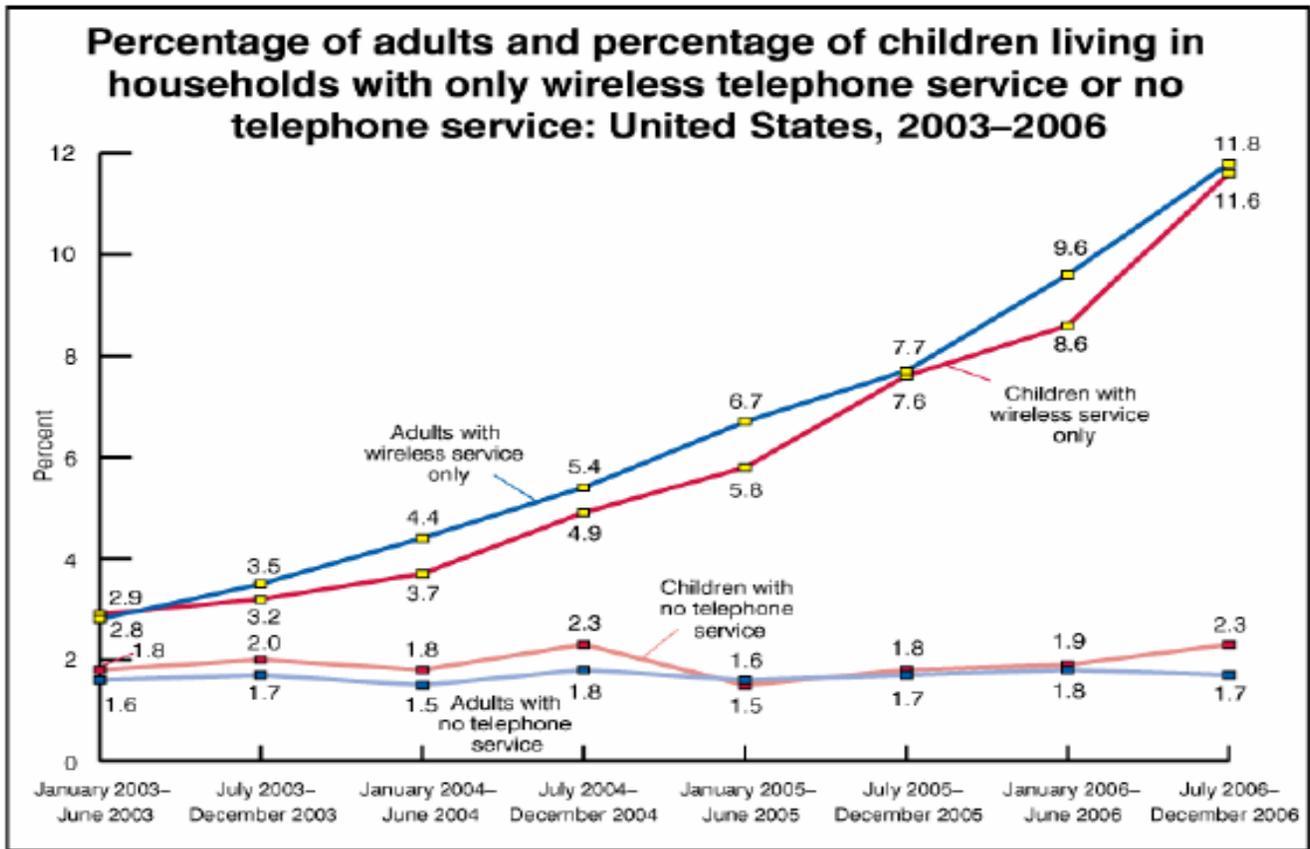


Child Rates
 (data through 9/16/2007)



Appendix C: Trends in Prevalence of U.S. Households by Type of Telephone Service

Wireless Substitution: Early release of estimates based on data from the NHIS, July-December 2006 (Blumberg et al., NCHS Health E-Stat 2007)



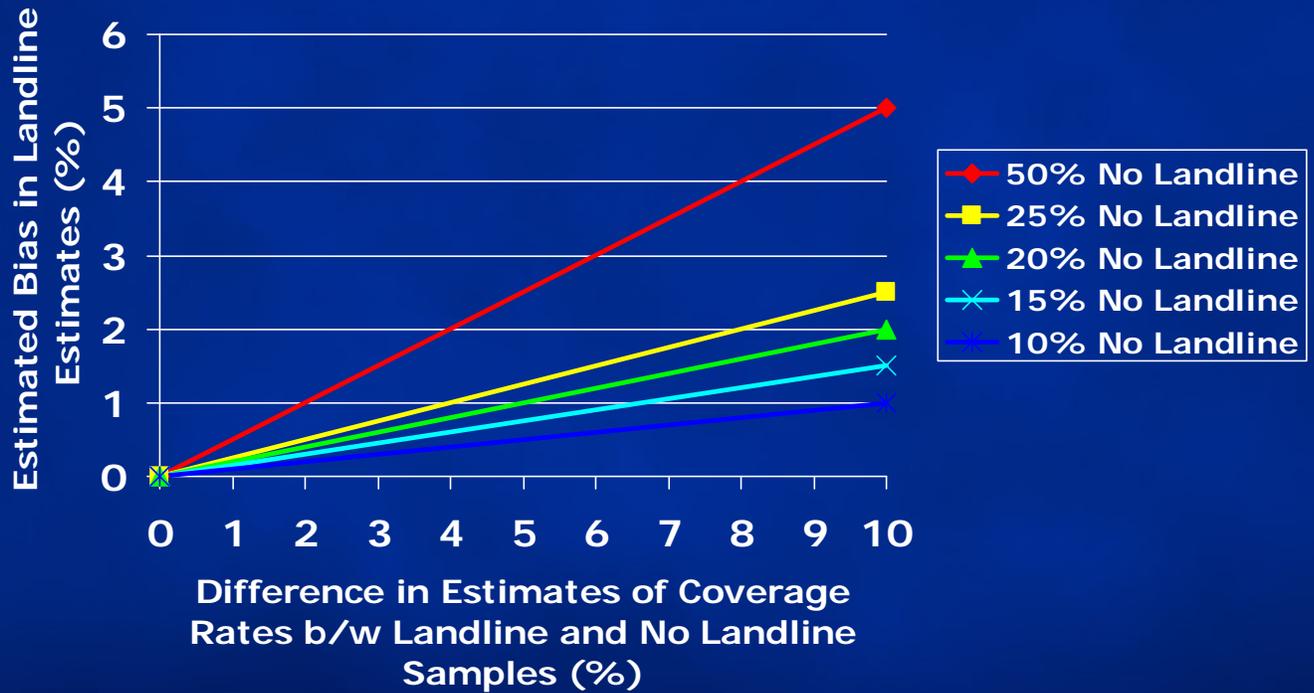
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Appendix E: Potential Bias in Landline Samples

Potential Bias in Landline Sample



DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION



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