Comparison of NIS and NHIS/NIPRCS Vaccination Coverage Estimates

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Background: The National Immunization Survey (NIS) and the National Health Interview Survey (NHIS) produce national coverage estimates for children aged 19 months to 35 months. The NIS is a cost-effective, random-digit-dialing telephone survey that produces national and state-level vaccination coverage estimates. The National Immunization Provider Record Check Study (NIPRCS) is conducted in conjunction with the annual NHIS, which is a face-to-face household survey. As the NIS is a telephone survey, potential coverage bias exists as the survey excludes children living in nontelephone households.

Methods: To assess the validity of estimates of vaccine coverage from the NIS, we compared 1995 and 1996 NIS national estimates with results from the NHIS/NIPRCS for the same years.

Results: Both the NIS and the NHIS/NIPRCS produce similar results.

Conclusion: The NHIS/NIPRCS supports the findings of the NIS.

Medical Subject Headings (MeSH): child, health surveys, immunization, quality assurance, vaccination (Am J Prev Med 2001;20(4S):25–27)

Background

The National Immunization Survey (NIS) is a large, ongoing, random-digit-dialing telephone survey that produces national and state-level vaccination coverage estimates. Because the NIS is a telephone survey, potential coverage bias exists because the survey excludes children living in nontelephone households. To assess the validity of estimates of vaccine coverage from the NIS, we compared 1995 and 1996 NIS national estimates with results from the National Immunization Provider Record Check Study (NIPRCS) for the same years and age group. The NIPRCS is conducted in conjunction with the annual National Health Interview Survey (NHIS), which is a face-to-face household interview survey.

The NHIS is an annual cross-sectional survey of the civilian, non-institutionalized U.S. population. Since 1991, the NHIS has collected vaccination data at the national level for children aged <6 years.[1] During the immunization section of the NHIS, the respondent can either report from the child's written vaccination record or

all immunizations (type and date) the child received, or report from memory the number of doses (an unsolicited "all" is an acceptable response) of each immunization. The NIPRCS was implemented in 1994 to improve the accuracy of the national vaccination coverage estimates produced from the NHIS. The NIPRCS results are used to adjust the NHIS vaccination coverage estimates for household respondent reporting error.[2] Zell et al.[3] documented the improvement in coverage estimates with the inclusion of the NIPRCS in the NHIS.

As part of the NHIS interview, respondents are asked to provide the contact information (name, address, and telephone number) of up to three of their child's vaccination providers and to sign a consent form to allow a provider to release the child's vaccination information. The NIPRCS data collection consists of mailing an immunization history questionnaire to all identified providers to obtain the dates of all vaccinations, reconciliation of household and provider data, and follow up on nonresponses.[2]

The NIS is a cost-effective means of conducting rapid population-based vaccination surveillance for children aged 19 to 35 months. As in the NHIS, the NIS collects vaccination information from written vaccination records or parental recall and a medical provider record–check component. The NIS obtains verbal consent from the parent or guardian to release vaccination records from the medical provider. Details of the NIS design have been described in the literature.[4,5] Because the NIS is a telephone survey, there is the possibility of

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Am J Prev Med 2001;20(4S)
Published by Elsevier Science Inc.

0749-3797/01/$–see front matter **25**
PII S0749-3797(01)00284-7

Table 1. Vaccination coverage among children aged 19 to 35 months, by selected vaccines and household phone status, NHIS/NIPRCS, 1995 and 1996

	1995		1996	
	Phone (n=1266) % (95% CI)	No phone (n=98) % (95% CI)	Phone (n=948) % (95% CI)	No phone (n=69) % (95% CI)
≥4 doses DTP[a]	80 (±2.4)[e]	68 (±11.3)[e]	83 (±2.5)	79 (±12.9)
≥3 doses polio	87 (±1.8)	80 (±10.5)	93 (±2.0)	89 (±8.3)
≥1 dose MCV[b]	92 (±1.7)	83 (±10.4)	92 (±1.9)	87 (±8.3)
≥3 doses Hib[c]	92 (±1.6)	86 (±7.9)	94 (±1.7)	86 (±8.7)
≥3 doses hepatitis B	66 (±3.2)	54 (±12.5)	83 (±3.0)	85 (±9.8)
4:3:1:3[d]	76 (±2.6)	65 (±11.2)	80 (±2.6)	74 (±12.9)

[a]Diphtheria and tetanus toxoids and pertussis vaccine/diphtheria and tetanus toxoids.
[b]Measles-containing vaccine.
[c]*Haemophilus influenzae* type b.
[d]Four doses of DTP/DT, three doses poliovirus, one dose of measles-containing vaccine, and three doses of *Haemophilus influenzae* type b.
[e]The difference between the vaccination estimates of children in households with phones and without phones was statistically significant ($p<0.05$) for the four doses of DTP in 1995. This does not account for multiple comparisons.
CI, confidence interval; NHIS/NIPRCS, National Health Interview Survey/National Immunization Provider Record Check Study.

coverage bias in its estimates because the survey excludes children living in nontelephone households. Telephone coverage is not uniformly distributed in the U.S. population[6] and coverage varies by sociodemographic and socioeconomic characteristics. Moreover, studies have found that people without telephones have lower health indicators.[7–9] People living below the poverty level and young people (aged 18 years to 24 years) have lower rates of telephone coverage[8]; people in these groups are often the parents of undervaccinated infants.[10]

Weighted data from the 1995 and 1996 NHIS/NIPRCS indicate that vaccination coverage levels are generally lower among children in nontelephone households compared to telephone households (Table 1). Although vaccination coverage among children in nontelephone households appears lower than children living in telephone households, nontelephone household vaccination-coverage levels are still high and most of the differences were not statistically significant ($p>0.05$) using two-sided t tests. This could be due to the small sample size of children aged 19 to 35 months in nontelephone households. The NIS uses the ratio of the NHIS/NIPRCS 4:3:1 series (≥4 DTP, ≥3 polio, and >1 MMR) vaccination-coverage level of children living in nontelephone households to that of children in telephone households as part of its calculations for a national ratio adjustment factor to reduce nontelephone coverage bias in the NIS.[4,5,11,12] This noncoverage adjustment is one of many statistical adjustments in the NIS, such as adjustments for household and provider nonresponse. An enhanced method to adjust for noncoverage of nontelephone households in the NIS is under investigation and uses information on interruptions in telephone service at the state level.[13]

Methods

To assess the validity of the NIS vaccination coverage estimates, national coverage levels for the NHIS/NIPRCS and the NIS from 1995 and 1996 were compared for each

individual vaccine and vaccine series.[14] SUDAAN version 7.5[15] software produced all vaccination coverage estimates and standard errors. In order to better compare the vaccination coverage estimates, we used NHIS/NIPRCS data from all phases of the NHIS/NIPRCS data collection; this is more accurate than using information from the initial provider survey only. The NIS estimates are based on data from an initial provider survey only; inclusion of a reconciliation or nonresponse follow-up study component would be costly and would delay the release of timely data.

Results

As seen in Table 2, the NIS and the NHIS/NIPRCS produce comparable estimates of vaccination coverage, despite their different survey methodologies and sample sizes. The NIS sample for analysis is about 20,000 and the NHIS/NIPRCS sample is about 1000. Between 1995 and 1996, both the NIS and NHIS/NIPRCS show an increase in vaccination coverage for all vaccines and vaccine series. In addition, for both surveys, the increase in coverage is of the same magnitude. Except for the 1995 MCV vaccination estimates, the differences between the NIS and the NHIS/NIPRCS vaccination estimates were not statistically significant at $\alpha=0.05$.

Conclusion

The NHIS/NIPRCS provides information concerning the ratio of vaccination coverage in nontelephone and telephone households and illustrates the high level of vaccination coverage in telephone and nontelephone households. The NHIS/NIPRCS data are used to make direct statistical adjustments for the lack of inclusion of nontelephone households in NIS estimates. Without the adjustment for nontelephone coverage, the NIS would overestimate vaccination coverage. Using NHIS/NIPRCS data for the nontelephone coverage does not force the NIS vaccination coverage estimates to agree with the NHIS/NIPRCS coverage estimates; rather, it makes an

Table 2. NIS and NHIS/NIPRCS vaccination coverage rates by selected vaccines, 1995 and 1996

	1995		1996	
	NIS[a] (*n*=16,699) % (95% CI)	NHIS/NIPRCS (*n*=1379) % (95% CI)	NIS[a] (*n*=21,099) % (95 CI)	NHIS/NIPRCS (*n*=1027) % (95% CI)
≥4 doses DTP[b]	79 (±1.0)	79 (±2.4)	81 (±0.7)	83 (±2.5)
≥3 doses polio	88 (±0.8)	87 (±1.8)	91 (±0.5)	92 (±2.1)
≥1 dose MCV[c]	88 (±0.7)[d]	91 (±1.7)[d]	91 (±0.5)	91 (±2.0)
≥3 doses Hib[e]	92 (±0.6)	91 (±1.5)	92 (±0.5)	93 (±1.8)
≥3 doses hepatitis B	68 (±1.0)	65 (±3.0)	82 (±0.7)	83 (±3.0)
4:3:1:3[f]	74 (±1.0)	75 (±2.5)	77 (±0.8)	79 (±2.5)

[a]The NIS estimates are adjusted for households without telephones.
[b]Diphtheria and tetanus toxoids and pertussis vaccine/diphtheria and tetanus toxoids.
[c]Measles-containing vaccine.
[d]The difference between the NIS and NHIS/NIPRCS 1995 MCV vaccination estimate was statistically significant at ∝ = .05, $p<.01$. The NIS and NHIS/NIPRCS estimates are slightly positively correlated. The *p*-value does not account for correlation.
[e]*Haemophilus influenzae* type b.
[f]Four doses of DTP/DT, three doses poliovirus, one dose of measles-containing vaccine, and three doses of *Haemophilus influenzae* type b.
CI, confidence interval; NIS, National Immunization Survey; NHIS/NIPRCS, National Health Interview Survey/National Immunization Provider Record Check Study.

adjustment to the weights used in estimating coverage estimates that are representative of the target population. Thus, the availability of the NHIS/NIPRCS estimates permits assessment of the quality of the NIS estimates.

Validating the NIS estimates with a comparable survey is important; all surveys have some limitations. The NIS does not collect data from nontelephone households, but unlike the NHIS/NIPRCS, the NIS can provide timely vaccination coverage estimates for all states and 28 cities/counties. In general, the NIS vaccination coverage estimates were comparable to those produced from the NHIS/NIPRCS. Although the NIS currently relies on NHIS/NIPRCS for the nontelephone adjustment, this adjustment is only one of many adjustments made to the sampling weights. Others include adjustments for household and provider nonresponse, poststratification adjustment for population undercoverage, and adjustments for households with multiple telephone lines. All complex surveys require the consideration of adjustments to account for the sample design, nonresponse, and population undercoverage.

By including a provider component to address issues of inaccurate or incomplete household vaccination history and using NHIS/NIPRCS information to adjust directly for nontelephone coverage bias, the NIS has estimates of the highest quality. The NIS has shown that a telephone survey can provide valid vaccination coverage levels when provider data are combined with household data and when direct adjustments for nontelephone coverage bias are made. NHIS/NIPRCS data validate NIS findings and offer additional vaccination surveillance for telephone and nontelephone households at the national level.

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