Impact of Health Insurance Status on Vaccination Coverage in Children 19–35 Months Old, United States, 1993–1996

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SYNOPSIS

Objectives. To show how health insurance (privately and publicly insured, insured and uninsured) relates to vaccination coverage in children 19–35 months old, and how this can be used to better target public health interventions.

Methods. The National Health Interview Survey (NHIS) gathers information on the health and health care of the U.S. non-institutionalized population through household interviews. The authors combined immunization and health insurance supplements from the 1993 through 1996 NHIS, and classified children 19–35 months old by their immunization and insurance status. Results were compared using both bivariate and multivariate analyses, and the backwards stepwise selection method was used to build multivariate logistic regression models.

Results. Uninsured children tended to have lower vaccination coverage than those who had insurance, either private or public. Among those with insurance, publicly insured children had lower vaccination coverage than privately insured children. Backwards stepwise regression retained insurance status, metropolitan statistical area, and education of responsible adult family member as major predictors of immunization. Factors considered but not retained in the final model included child race/ethnicity, family poverty index, and region of country.

Conclusions. Insurance status was a critical predictor of vaccination coverage for children ages 19–35 months. After controlling for confounders, the uninsured were about 24% less likely to receive all recommended shots than the insured and, among the insured, those with public insurance were about 24% less likely to receive all recommended vaccines than those with private insurance.

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The relationship between insurance and childhood vaccination coverage in a narrow segment of the population, such as among children of employees of a particular corporation or among low income children, has been widely studied.[1–3] The relationship between insurance and vaccination coverage in children in various age groups has, on a national scale, been studied (younger than 7 years of age,[4] younger than 18 years of age).[5–7] The impact of insurance on childhood vaccination coverage specifically for preschool children has been little studied on a national scale. In this study, we compare vaccination coverage among insured and uninsured preschool children. We also compare vaccination coverage among those who are insured between children with private insurance and public insurance; these terms are defined below.

METHODS

The National Health Interview Survey (NHIS) gathers information on the health and health care of the U.S. non-institutionalized population through household interviews. Data gathered include self-reported immunization history and self-reported insurance coverage status. Details of the NHIS sampling design appear elsewhere.[8,9]

We focused attention on children 19–35 months old; this age range makes results comparable with those of the National Immunization Survey (NIS), which reports only provider-verified immunizations.[10] To obtain both immunization and health insurance information, we merged NHIS immunization and NHIS health insurance supplements. However, the number of children with insurance information in each NHIS survey year is small. We did trend analysis for the proportions of insured, privately insured, and publicly insured children over the period of 1993 through 1996. The *p*-values of chi-square test for trend were 0.63, 0.93, and 0.72 respectively. This means that there is no secular trend over the years 1993 through 1996 for children's health insurance status. Power and sample size analysis showed that we needed at least 75 children in all of the analysis cells in order to detect a minimum coverage difference of 15% with power equal to 80%. To increase the number of 19–35-month-old children and to achieve sufficient statistical test power, we combined NHIS immunization and health insurance supplements from the NHIS surveys for years 1993 through 1996 (N=7,535). Children were classified as *insured*, *uninsured*, and *unknown insured*. Children were called insured if covered by any insurance plan (e.g., private insurance, Medicaid, Military health care), uninsured if not covered by any insurance, and unknown insured (if the answer was "Don't know"). Of those who were insured, insurance coverage was classified as *privately insured* (enrolled in at least one general purpose private health plan), *publicly insured* (not covered by any private health plan, but covered by Medicaid or some other public assistance), or *other insured* (if the child was covered by Civilian Health and Medical Program Uniformed Service [CHAMPUS], Civilian Health and Medical Program of the Department of Veterans Affairs [CHAMP-VA], or other Military health care).

In addition to classification by health insurance, children were classified as complete/incomplete with a given vaccine or series of vaccines. Based on all vaccination information at the time of the household interview, children were classified as *complete/incomplete* with a given vaccine as follows: four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine including diphtheria and tetanus toxoids, and any acellular pertussis vaccine (DTP4); three or more doses of any poliovirus vaccine (Polio); one or more dose of measles-containing vaccine (MCV); three or more doses of *Haemophilus influenzae* type b (Hib) vaccine; and three or more doses of hepatitis B (HepB) vaccine. Children were classified as '4:3:1:3 complete' or 'not 4:3:1:3 complete' depending on if the children had/had not received the number of doses of DTP4, Polio, MCV, and Hib reported above.

We compared vaccination coverage between insured and uninsured children and between those privately insured and those publicly insured by demographics. To investigate the multivariate relationship between vaccination coverage and health insurance status and demographics, we conducted multivariate backwards stepwise logistic regression, with 4:3:1:3 complete as the dependent variable and assorted demographics including insurance status and insurance type as candidate independent variables. This process was repeated, with insurance type (privately insured, publicly insured, other insured, uninsured, unknown insured) replacing insurance status (insured, uninsured, unknown insured). This was done to establish that the differences in completeness were not due solely to differences in demographics. During each backwards model selection step, the most nonsignificant factor with Wald F *p*-value greater than 0.1 was dropped. This process continued until all Wald F *p*-values for the factors left in the model were less than 0.1.

All computations were performed with SAS version 8.0[11] and SUDAAN 7.0.[12] SAS was used for data management, and inside SAS, we used SAS-Callable SUDAAN to call SUDAAN Procedures to analyze com-

plex survey data NHIS. SUDAAN is a software package which supports analysis of data from complex sample surveys, such as NHIS.

RESULTS

Of all children in this study, 83.5% (95% confidence interval [CI] 82.5, 84.5) were insured, and 12.8% (95% CI 11.8, 13.8) were uninsured. Of all children, 56.4% (95% CI 54.8, 58.0) were privately insured, while 24.9% (95% CI 23.6, 26.2) were publicly insured. These percentages varied by ethnicity, income, and education (Table 1). Being uninsured was much more common among children of Hispanic race/ethnicity, children who lived below the poverty level, and children whose responsible adult family member had less than 12 years education. Children of African American/Hispanic race/ethnicity, children living below the poverty level, and children whose responsible adult family member had less than 12 years education were much more likely to be publicly insured.

Further, vaccination coverage differed significantly at *p*-values of less than 0.01 for all comparisons between insured and uninsured, and between privately and publicly insured children (Table 2). Uninsured and publicly insured children uniformly reported lower vaccination coverage than insured and privately insured children, respectively. The largest differences between insured and uninsured were found for the DTP4 at 8.4% (95% CI 4.4, 12.4), Hib at 8.0% (95% CI 5.9, 11.9), and HepB at 8.8% (95% CI 4.6, 13). Also, the largest differences between privately insured and publicly insured were found for the DTP4 at 6.5% (95% CI 3.6, 9.4), and Hib at 8.2% (95% CI 4.9, 11.5).

Table 1. Comparison of insurance status among 19–35 months old children by demographics (combined data from the 1993–1996 National Health Interview Survey)

	Uninsured	*Insured*	*Privately insured*	*Publicly insured*
	Percent (95% CI)	*Percent (95% CI)*	*Percent (95% CI)*	*Percent (95% CI)*
National	12.8 (11.8, 13.8)	83.5 (82.5, 84.5)	56.4 (54.8, 58.0)	24.9 (23.6, 26.2)
Race/ethnicity				
Non-Hispanic white	10.9 (9.7, 12.1)	86.1 (84.8, 87.4)	68.2 (66.3, 70.1)	15.5 (14.1, 16.9)
Non-Hispanic African American	10.7 (8.8, 12.6)	84.0 (81.7, 86.3)	32.4 (29.1, 35.7)	49.0 (45.6, 52.4)
Hispanic	20.9 (18.7, 23.1)	75.4 (72.8, 78.0)	35.3 (32.6, 38.0)	38.7 (36.1, 41.3)
Poverty status[a]				
At or above poverty level	11.2 (10.0, 12.4)	85.7 (84.5, 86.9)	72.5 (70.8, 74.2)	10.5 (9.4, 11.6)
Below poverty level	16.6 (14.5, 18.7)	79.8 (77.5, 82.1)	12.9 (11.0, 14.8)	66.1 (63.3, 68.9)
Education of responsible family member				
≤12 years	17.3 (15.7, 18.9)	78.6 (76.9, 80.3)	35.9 (33.8, 38.0)	40.3 (38.3, 42.3)
>12 years	8.9 (7.8, 10.0)	88.1 (86.9, 89.3)	74.6 (72.8, 76.4)	11.5 (10.2, 12.8)
Urbanicity				
Urban	14.0 (12.2, 16.2)	82.0 (80.1, 83.9)	44.3 (41.4, 47.2)	35.5 (33.1, 37.9)
Suburban	11.2 (9.8, 12.6)	85.2 (83.7, 86.7)	65.5 (63.2, 67.8)	17.4 (15.7, 19.1)
Rural	14.9 (12.5, 17.3)	82.1 (79.4, 84.8)	54.6 (51.1, 58.1)	25.2 (22.5, 27.9)
Region				
North East[b]	10.4 (8.2, 12.6)	86.8 (84.5, 89.1)	63.7 (59.8, 67.6)	22.8 (20.1, 25.5)
Midwest[c]	8.7 (7.1, 10.3)	88.8 (86.9, 90.7)	64.8 (61.5, 68.1)	23.5 (20.8, 26.2)
South[d]	15.4 (13.5, 17.3)	79.4 (77.3, 81.5)	49.1 (46.5, 51.7)	26.7 (24.4, 29.0)
West[e]	15.5 (13.4, 17.5)	81.3 (79.2, 83.4)	52.1 (48.6, 55.6)	25.4 (23.0, 27.8)

[a]Based on family size, number of children younger than 18 years of age, and family income.

[b]States: ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE

[c]States: OH, IN, IL, MI, WI, MO, IA, MN, ND, SD, NE, KS

[d]States: DE, MD, DC, WV, VA, NC, SC, KY, TN, GA, AL, MS, FL

[e]States: WA, OR, MT, ID, WY, CO, UT, NV, CA, AZ, NM

CI = confidence interval

Table 2. Comparison of vaccination coverage among children 19–35 months old by insurance status (combined data from the 1993–1996 National Health Interview Surveys)

	Insured children	*Uninsured children*	*Privately insured children*	*Publicly insured children*
Vaccine or vaccination series	*Percent (95%CI)*	*Percent (95%CI)*	*Percent (95%CI)*	*Percent (95%CI)*
DTP3[a]	90.6 (89.6, 91.6)	86.5 (83.9, 89.1)	92.7 (91.8, 93.8)	86.2 (84.2, 88.2)
DTP4[b]	73.5 (72.0, 75.4)	65.1 (61.3, 68.9)	75.7 (74.0, 77.4)	69.2 (66.6, 71.8)
Polio[c]	83.4 (82.1, 84.7)	78.6 (75.4, 81.8)	84.9 (83.4, 86.4)	81.2 (78.9, 83.5)
Hib[d]	74.1 (72.6, 75.6)	66.1 (62.5, 69.7)	76.8 (75.0, 78.6)	68.6 (65.8, 71.4)
MCV[e]	90.5 (89.6, 91.4)	86.7 (84.0, 89.4)	91.7 (90.6, 92.8)	87.6 (85.8, 89.4)
HepB[f]	51.0 (48.9, 53.1)	42.2 (38.0, 46.4)	52.7 (50.2, 55.2)	48.5 (45.2, 51.8)
4:3:1:3[g]	61.5 (59.8, 63.2)	53.2 (49.4, 57.0)	64.7 (62.8, 66.6)	55.6 (52.6, 58.6)

[a]Three or more doses of any diphtheria and tetanus toxoids and pertussis vaccines including diphtheria and tetanus toxoids, and any acellular pertussis vaccine (DTP/DTaP/DT)

[b]Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccines including diphtheria and tetanus toxoids, and any acellular pertussis vaccine (DTP/DTaP/DT)

[c]Three or more doses of any poliovirus vaccine

[d]Three or more doses of *Haemophilus influenzae* type b (Hib) vaccine

[e]One or more doses of measles-containing vaccine (MCV)

[f]Three or more doses of hepatitis B (HepB) vaccine

[g]Four or more doses of DTP, three or more doses of poliovirus vaccine, one dose or more of any MCV, and three or more doses of Hib

CI = confidence interval

The national coverage of being 4:3:1:3 complete differed significantly among insured and uninsured children, and between privately and publicly insured children (p-value<0.01) (Table 3). Vaccination coverage of 4:3:1:3 complete for uninsured or publicly insured children was less than the coverage for insured or privately insured children for all of the demographic strata. The largest differences in coverage between those who were insured and those who were uninsured, 19.0% (95% CI 9.0, 29.0), and the largest difference in coverage between those who were privately insured and those who were publicly insured, 18.0%, (95% CI 11.2, 25.0) occurred in the Midwest (OH, IN, IL, WI, MI, IA, MO, MN, ND, SD, NE, KS). Other groups that showed large differences were: white non-Hispanic race/ethnicity, education of responsible adult family member >12 years, suburban resident children, and those living below the poverty level (private vs. publicly insured only).

Odds ratios for the final models selected via backwards stepwise logistic regression appear in Table 4. In the two final models, the significant predictive factors for 4:3:1:3 completeness were insurance status or insurance type, education of responsible family member, and residence in a metropolitan statistical area. These factors were, approximately, equally predictive. The first model showed that insurance status, education, and residence in a metropolitan statistical area were the significant factors predictive of children being 4:3:1:3 complete. The second model showed that insurance type, education, and residence in a metropolitan statistical area were the significant factors predictive of children being 4:3:1:3 complete. The two models showed that being insured or privately insured were the strongest predictors of children 4:3:1:3 completeness. In the process of establishing final models, race/ethnicity, poverty index, and region of country were considered since they were predictors, but not as strong as insurance type, education, and residence in a metropolitan statistical area. By our removal criterion, factors with a p-value greater than 0.1 were not retained in the final model, but they were still predictors. In all of the backwards selection models, both health insurance type or heath insurance status are significant factors. Specifically, the Wald F p-values for children's health insurance status are less than 0.002, and the Wald F p-values for children's health insurance type are less than 0.0001 for all of the models, from full models to the final selected models. Therefore, the logistic regression results showed that both health insurance type and health insurance status are always the significant factors for predicting 4:3:1:3 completeness in children.

Table 3. Comparison of 4:3:1:3[a] coverage among children 19–35 months old, by demographics (combined data from the 1993–1996 National Health Interview Survey)

	Insured	*Uninsured*	*Privately insured*	*Publicly insured*
	Percent (95% CI)	*Percent (95% CI)*	*Percent (95% CI)*	*Percent (95% CI)*
National[b,c]	61.5 (59.8, 63.2)	53.2 (49.4, 57.0)	64.7 (62.8, 66.6)	55.6 (52.6, 58.6)
Race/ethnicity				
Non-Hispanic white[b,c]	63.0 (60.9, 65.1)	53.3 (47.7, 59.0)	65.4 (63.2, 67.6)	55.0 (50.1, 60.0)
Non-Hispanic African American	55.5 (50.8, 60.2)	51.4 (39.7, 63.1)	60.9 (53.7, 68.1)	53.8 (48.1, 59.5)
Hispanic[b]	59.8 (56.4, 63.2)	52.0 (45.6, 58.4)	62.1 (56.7, 67.5)	58.2 (53.4, 63.0)
Poverty status[d]				
At or above poverty level[b]	63.3 (61.5, 65.1)	54.9 (50.1, 59.7)	64.7 (62.7, 66.7)	59.2 (53.6, 64.8)
Below poverty level[c]	55.6 (52.1, 59.1)	53.1 (44.9, 61.3)	67.1 (59.3, 74.9)	53.5 (49.6, 57.4)
Education of responsible family member				
≤12 years	57.3 (54.8, 59.8)	52.9 (48.2, 57.6)	60.4 (56.7, 64.1)	55.6 (52.2, 59.0)
>12 years[b,c]	64.6 (62.4, 66.8)	54.2 (47.6, 60.8)	66.5 (64.2, 68.8)	55.6 (49.2, 62.0)
Urbanicity				
Urban[c]	57.6 (54.5, 60.7)	52.6 (45.9, 59.3)	61.5 (57.7, 65.3)	54.7 (50.1, 59.3)
Suburban[b,c]	63.8 (61.4, 66.2)	52.2 (46.9, 57.6)	66.1 (63.5, 68.7)	56.2 (51.1, 61.3)
Rural[c]	61.6 (57.9, 65.3)	56.0 (48.0, 64.0)	65.0 (60.4, 69.6)	56.5 (50.1, 62.9)
Region				
North East[c,e]	62.5 (58.4, 66.6)	61.5 (51.8, 71.2)	64.4 (60.1, 68.7)	56.7 (49.4, 64.0)
Midwest[b,c,f]	61.7 (58.5, 64.9)	42.7 (32.8, 52.6)	66.3 (63.1, 69.5)	48.3 (41.8, 54.8)
South[b,c,g]	60.3 (57.3, 63.3)	52.9 (47.1, 58.7)	64.6 (60.7, 68.5)	55.7 (50.5, 60.9)
West[h]	61.9 (58.6, 65.2)	54.9 (48.6, 61.2)	63.2 (58.9, 67.5)	61.4 (55.8, 67.0)

[a]Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine including diphtheria and tetanus toxoids, and any acellular pertussis vaccine; three or more doses of any poliovirus vaccine; one or more dose of measles-containing vaccine; three or more doses of *Haemophilus influenzae* type b (Hib) vaccine

[b]Factors that differ between insured and uninsured at the 0.05 level

[c]Factors that differ between privately and publicly insured at the 0.05 level

[d]Based on family size, number of children younger than 18 years of age, and family income

[e]States: ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE

[f]States: OH, IN, IL, MI, WI, MO, IA, MN, ND, SD, NE, KS

[g]States: DE, MD, DC, WV, VA, NC, SC, KY, TN, GA, AL, MS, FL

[h]States: WA, OR, MT, ID, WY, CO, UT, NV, CA, AZ, NM

CI = confidence interval

DISCUSSION

Insurance status and insurance type were significant predictors of 4:3:1:3 coverage: after controlling for confounders, the uninsured were about 24% less likely to receive 4:3:1:3 as the insured, and those with public insurance were about 24% less likely to receive 4:3:1:3 as those with private insurance. Steps should be taken to encourage immunization for children among both the uninsured and those with public insurance. This is particularly true of the fourth dose of DTP, which is needed to prevent pertussis in pre-school children.

In Table 4, we found a large degree of heterogeneity among the three different insurance types—children with public insurance were about 24% less likely to receive 4:3:1:3 as those with private insurance, and uninsured children were about 33% less likely to receive 4:3:1:3 as those with private insurance. The situation for children with other insurance was even worse—they were about 59% less likely to receive 4:3:1:3 as those with private insurance. Other insurance included CHAMPUS/CHAMP-VA or other Military health care. Why does other insurance result in such a low odds ratio (0.41) of children being completely

Table 4. Odds ratios in the final models via backwards stepwise logistic regression for 4:3:1:3[a] completeness (combined data from the 1993–1996 National Health Interview Survey)

		Insurance status in the model	*Insurance type in the model*
Factor		*Odds ratio (95% CI)*	*Odds ratio (95% CI)*
Insurance status	Unknown	0.76 (0.53, 1.09)	NA
	Uninsured	0.76 (0.64, 0.89)	NA
	Insured	1.00 (ref.)	NA
Insurance type	Unknown	NA	0.67 (0.47, 0.96)
	Uninsured	NA	0.67 (0.56, 0.80)
	Other insured	NA	0.41 (0.28, 0.61)
	Publicly insured	NA	0.76 (0.65, 0.89)
	Privately insured	NA	1.00 (ref.)
Education of responsible family member	Unknown	0.67 (0.30, 1.51)	0.97 (0.39, 2.42)
	≤12 years	0.77 (0.68, 0.87)	0.84 (0.73, 0.97)
	>12 years	1.00 (ref.)	1.00 (ref.)
Urbanicity	Urban	0.82 (0.71 – 0.95)	0.85 (0.74, 0.99)
	Rural	0.97 (0.82 – 1.15)	0.98 (0.82, 1.16)
	Suburban	1.00 (ref.)	1.00 (ref.)

[a]Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine including diphtheria and tetanus toxoids, and any acellular pertussis vaccine; three or more doses of any poliovirus vaccine; one or more dose of measles-containing vaccine; three or more doses of *Haemophilus influenzae* type b (Hib) vaccine.

CI = confidence interval

NA = not applicable

immunized, even lower than that for uninsured children (odds ratio= 0.67)? Is the military health care system ignoring the immunization guidelines? These types of questions remind public health workers that more research is needed to find out why children with CHAMPUS/CHAMP-VA or other Military health insurance had such low vaccination coverage.

Health insurance type or insurance status, education of the responsible family member, residence in metropolitan statistical area (urbanicity), race/ethnicity, poverty status, and region of country were all related to 4:3:1:3 coverage. Although the factors retained in the final models for 4:3:1:3 coverage were education, residence in metropolitan statistical area, and insurance status (insured, uninsured, unknown insured) or insurance type (privately/publicly insured, other insured, uninsured, unknown insured), the minorities and poor children are still more likely to be uninsured or publicly insured. Thus, interventions designed to increase vaccination coverage among children ages 19–35 months should be targeted not only to those children of uninsured/publicly insured, children whose responsible family member has less than 12 years of education, and children who live in an urban setting, but also to those children with family income below poverty level, and minorities such as non-Hispanic African American and Hispanic children.

These results are subject to three major limitations. First, NHIS data were self-reported and not provider-verified, even if some of the responsible adult family members presented the children's vaccination shot cards at the time of interview. Second, although the NHIS is the current major resource that links children's vaccination coverage with health insurance for 1993 through 1996, the data still are several years old, and we do not know how the relationship between insurance status and vaccination coverage might have changed since 1997. Third, based on the Childhood Immunization Initiative (CII) and Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP),[13,14] we considered health insurance status and immunization coverage with individual vaccines and selected vaccination series only for children ages 19–35 months in this study. This age range, 19–35 months old, covers most of the recommended vaccination shots during a child's life. However, this study did not consider the vaccination coverage for children

ages 3–5 years old, nor for school age children 5–14 years old.

IMPLICATIONS

This report has shown that among children 19–35 months old there were about 2.9 million children without health insurance and about 5.6 million with public health insurance during the years 1993 through 1996. Uninsured and publicly insured children were less likely than insured and privately insured children to be up-to-date in their vaccinations. Especially, the children with CHAMPUS/CHAMP-VA or other Military health insurance were far less likely to have their vaccinations up-to-date than privately insured children.

The State Child Health Insurance Program (SCHIP) has been successful in increasing the number of children with health insurance since 1997. Programs such as Vaccines for Children (VFC), and WIC have improved vaccination coverage for poor children. Public health workers should make those programs even more effective. In addition, intervention should be targeted more to children with public health insurance and children with CHAMPUS/CHAMP-VA or other Military health insurance. The continued decline in employment-related health care benefits and the slow economy could result in a larger number of children without health insurance and the shift of children from private insurance to public insurance. These could cause more children to miss immunizations resulting in lower vaccination coverage rates.

REFERENCES

1. Fielding JE, Cumberland WG, Pettitt L. Immunization status of children of employees of a large corporation. JAMA 1994;271:525-30.
2. Rodewald LE, Szilagyi PG, Holl J, Shone LR, Zwanziger J, Raubertas RF. Health insurance for low-income working families. Effect on the provision of immunization to preschool-age children. Arch Pediatr Adolesc Med 1997; 151:798-803.
3. Szilagyi PG, Zwanziger J, Rodewald LE, Holl JL, Mukamel DB, Trafton S, et al. Evaluation of a state health insurance program for low-income children: implications for state child health insurance programs. Pediatrics 2000;105:363-71.
4. Rodewald LE, Shius T, Zill E, Dietz V, Szilagyi PG. Health insurance and under immunization: lessons from the 1991 National Health Interview Survey. Pediatric Research 1995;37:144.
5. Newacheck PW, Stoddard JJ, Hughes DC, Pearl M. Health insurance and access to primary care for children. New Engl J Med 1998;338:513-9.
6. Unmet needs: the large difference in health care between uninsured and insured children. Washington: Families USA, 1997. Also available from: URL: http://www.familiesusa.org/site/PageServer?pagename=media_reports_unmet
7. One out of three: kids without health insurance 1995–1996. Washington: Families USA, 1997. Also available from: URL: http://www.familiesusa.org/site/PageServer?pagename=media_reports_kwohi
8. Massey JT, Morre TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985–94. Vital Health Stat 2 2000(110):1-41.
9. Botman SL, Moore TF, Moriarity CL, Parsons VL. Design and estimation for the National Health Interview Survey, 1995–2004. Vital Health Stat 2 2000(130):1-41.
10. Smith PJ, Battaglia MP, Huggins VJ, Hoaglin DC, Roden A, Khare M, et al. Overview of the sampling design and statistical methods used in the National Immunization Survey. Am J Prev Med 2001; 20(4Suppl):17-27.
11. SAS Institute, Inc. SAS Version 8.0. Cary (NC): SAS Institute; 1999.
12. Shah BV, Barnwell GS, Bieler GS. SUDAAN user's manual. Release 7.0. Research Triangle Park (NC): Research Triangle Institute; 1996.
13. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep 1994;43(RR-1):1-39.
14. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). MMWR Morb Mortal Wkly Rep 2002;51(RR-2):1-36.