

# ASIAN AND PACIFIC ISLANDER CHILDHOOD VACCINATION COVERAGE: NATIONAL IMMUNIZATION SURVEY, 2002–2004

**Objective:** Public health data on Asian/Pacific Islanders are most often collected and reported as one aggregated group. This aggregation of data can mask potential differences among the many ethnic/national/cultural groups classified as Asian/Pacific Islanders. We used data from the National Immunization Survey (NIS) to examine immunization status for all US children and four mutually exclusive groups: Asian only, Native Hawaiian only, Pacific Islander only, and other.

**Methods:** We included information from 64,718 US children 19–35 months of age who had adequate vaccination histories from provider(s) for 2002 to 2004; among these, 2673 (4.3%) were Asian only, Native Hawaiian only, or Pacific Islander only. The sample sizes reported are unweighted, while results are based on weighted analyses.

**Results:** Vaccination coverage estimates for children in the Native Hawaiian only group were consistently higher than estimates for all US children, whereas those in the Asian only group were nearly the same. Children in the Pacific Islander only group had vaccination coverage estimates that were lower than estimates for all US children.

**Conclusion:** The results of this study indicated that although overall the Asian/Pacific Islander group had similar childhood vaccination coverage to all US children, the group does not have homogeneous coverage, with Pacific Islanders having lower coverage. Public health researchers should, whenever possible, examine individual groups of Asian/Pacific Islanders to more accurately measure the health status of this growing population. (*Ethn Dis.* 2008;18:72–76)

**Key Words:** Asians, Pacific Island Americans, Vaccination

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

From the National Center for Chronic Disease Prevention and Health Promotion (KS, SC), National Center for Immunizations and Respiratory Diseases (TS), Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

Kate M. Shaw, MS; Tammy A. Santibanez, PhD;  
Susan Y. Chu, PhD, MSPH

## INTRODUCTION

Asians/Pacific Islanders accounted for 4.5% of the total US population in 2000, and according to the US Census Bureau, Asians are increasing at a much faster rate than the population as a whole.<sup>1–3</sup> From 2000 to 2003, the number of people reporting Asian race increased 12.5%, from 12.0 million to 13.5 million, and those reporting Native Hawaiian and other Pacific Islander increased 5.8% from 907,000 to 960,000. The Asian/Pacific Islander group is diverse; in 2000, ethnic and national groups consisted of Chinese (21.4%), Filipino (18.5%), Asian Indian (14.9%), Korean (9.6%), Vietnamese (9.6%), Japanese (9.0%), Native Hawaiian (3.1%), other Pacific Islander (2.7%), Cambodian (1.6%), Laotian (1.6%), Pakistani (1.6%), Hmong (1.5%), Thai (1.2%), Taiwanese (1.1%), and Samoan (1.0%).<sup>1–2</sup>

In 1999 an executive order (EO 13125) was passed (and extended in 2001) that focused on increasing participation of Asian/Pacific Islanders in federal programs.<sup>4,5</sup> One of its goals was to increase collection of data related to Asian/Pacific Islander populations and subpopulations and to foster research and data on public health. However, data reported for Asian/Pacific Islanders are traditionally combined into the one aggregate group, which masks differences among the many ethnic/national/cultural groups that make up this population. There remains a paucity of public health research among the disag-

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gregated Asian/Pacific Islander groups.<sup>6–10</sup>

To our knowledge, no study has examined childhood immunization status among the individual Asian/Pacific Islander groups. We used data from the National Immunization Survey (NIS) to examine demographic characteristics and immunization status among this population.

## METHODS

The NIS is a random-digit-dialing survey conducted annually by the Centers for Disease Control and Prevention to obtain vaccination coverage for the US noninstitutionalized population of children aged 19–35 months. To obtain vaccination information, a follow-up survey is mailed to all of the eligible children's immunization health providers.<sup>11</sup> Results are weighted to be nationally representative. Details about the design and weighting have been previously published.<sup>12</sup>

We analyzed NIS data collected from 2002 to 2004, only including children who had adequate vaccination

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Address correspondence to: Kate M. Shaw, MS; CDC/NCCDPHP (MS K53); 4770 Buford Hwy, NE; Atlanta, GA 30341-3717; 770-488-4231; 770-488-3040 (fax); atk6@cdc.gov

histories from provider(s) to allow determination of the immunization history of the child. Children included in the 2002 NIS were born between January 1999 and June 2001; children included in the 2003 NIS were born between January 2000 and July 2002; and children included in the 2004 NIS were born between January 2001 and July 2003.

Respondents were asked to select all (more than one could be selected) categories that described their child's race, including White, Black or African American, American Indian, Alaska Native, Asian, Native Hawaiian, or other Pacific Islander. Of the 64,718 children with adequate provider data, 2673 (4.3%) selected Asian only, Native Hawaiian only, or Pacific Islander only. For this study, we categorized race into the following four, mutually exclusive, groups:

- Asian only: children with reported race as Asian and no other race
- Native Hawaiian only: children with reported race as Native Hawaiian and no other race
- Pacific Islander only: children with reported race as Pacific Islander and no other race
- Other: children not included in the previous groups

Demographic characteristics analyzed included: child's birth order, number and type of providers, and foreign-born status; maternal education level, marital status, and age; household income and poverty status; and residence in a metropolitan statistical area (MSA). Household income and poverty status were defined using US Census Bureau thresholds for poverty and respondent-reported household income and number of persons in the household. MSAs are defined by the US Office of Management and Budget as central city (the largest city or cities in the MSA), non-central city (the rest of the MSA that is not part of the central city), and non-MSA (all other places in

the United States that are not part of an MSA).

We evaluated vaccination coverage estimates by the age at interview (19–35 months) for the following vaccines/combinations: 3+DTP (three or more doses of diphtheria and tetanus toxoids and pertussis vaccine), 4+DTP (four or more doses of diphtheria and tetanus toxoids and pertussis vaccine), 3+Polio (three or more doses of poliovirus vaccine), 1+MMR (one or more doses of measles-containing vaccine), 3+Hib (three or more doses of *Haemophilus influenzae* type b vaccine), 3+HepB (three or more doses of hepatitis B vaccine), 1+Var (one or more doses of varicella vaccine), 3:3:1 (3+DTP, 3+Polio, and 1+MMR), 4:3:1 (4+DTP, 3+Polio, and 1+MMR), 4:3:1:3 (4:3:1 and 3+Hib), 4:3:1:3:3 (4:3:1:3 and 3+HepB), and 4:3:1:3:3:1 (4:3:1:3:3 and 1+Var). Wald Chi-square tests were used to test for differences between groups; post-hoc comparisons were made. All estimates and standard errors were calculated using SAS release 9.1 (SAS, Cary, NC, 2003) and SAS-callable SUDAAN release 9.0.0 (RTI, Research Triangle Park, NC, 2004), a software package designed to analyze complex survey data. We conducted all statistical tests with two-tailed alternatives,  $\alpha=.05$ .

## RESULTS

### Response Rate

For the 2002, 2003, and 2004 NIS datasets, respectively, we had adequate provider data for 21,410, 21,310, and 21,998 children. Council of American Survey Research Organizations (CASRO) response rates were 74.2%, 69.7%, and 73.3% for 2002, 2003, and 2004, respectively.

### Demographics

Demographic characteristics differed among children in the Asian only, Native Hawaiian only, and Pacific

Islander only groups (Table 1). Children in the Asian only group were more likely to have mothers who were college graduates (54.5%, 95% confidence interval [CI] 51.0%–58.0%;  $P<.01$ ),  $\geq 30$  years old (68.4%, 95% CI 65.1%–71.7%;  $P<.01$ ), and married (88.1%, 95% CI 85.8%–90.4%;  $P<.01$ ) than children in the Native Hawaiian only and Pacific Islander only groups. Children in the Native Hawaiian only group were more likely to have mothers who had only 12 years of education (53.2%, 95% CI 40.8%–65.6%;  $P<.05$ ). These three groups also differed by poverty status/income level. Children in the Asian only group were more likely to have a household income  $> \$75,000$  (24.7%, 95% CI 22.1%–27.3%;  $P<.05$ ) than children in the Native Hawaiian only and Pacific Islander only groups. No notable differences were seen among these groups by number and type of provider.

The Asian/Pacific Islander groups differed by foreign-born status and MSA status. By definition, children in the Native Hawaiian only group were not foreign born, compared to 3.4% (95% CI 2.0%–4.8%) of those in the Asian only group and 2.3% (95% CI 0.1%–4.5%) in the Pacific Islander only group. Additionally, children in the Asian only group were more likely to live in a MSA, non-central city area (58.3%, 95% CI 55.0%–61.6%;  $P<.05$ ). In contrast, children in the Native Hawaiian only group were more likely to live in a non-MSA area (32.5%, 95% CI 23.0%–42.0%;  $P<.01$ ). However, these results are confounded with state of residence; 63.9% (95% CI 48.0%–77.2%) of children in the Native Hawaiian only group lived in Hawaii.

### Vaccination Coverage

For the vaccination series, coverage estimates of the Native Hawaiian only group were higher than estimates for all US children. Further, the Pacific Islander only group had coverage esti-

**Table 1. Demographic characteristics of respondents, United States, National Immunization Survey, 2002–2004\***

Characteristic	US Total† (n=64,718)	Asian Only‡ (n=2263)	Native Hawaiian Only§ (n=195)	Pacific Islander Only   (n=215)	Asian Only, Native Hawaiian Only, and Pacific Islander Only¶ (n=2673)
Education					
<12 years	18.0±.6	15.0±3.0	7.8±4.5	19.2±10.9	15.2±2.8
12 years	34.3±.7	23.0±3.2	53.2±12.4	32.8±10.8	24.8±3.0
>12 years but non-college graduate	15.6±.4	7.5±1.6	19.0±7.3	22.2±9.2	9.0±1.6
College graduate	32.2±.6	54.5±3.5	19.9±11.9	25.8±9.0	51.1±3.2
Marital status					
Married	70.1±.6	88.1±2.3	62.2±13.1	70.0±11.2	85.8±2.3
Never married	21.7±.6	8.7±1.9	19.9±6.7	19.2±8.7	9.9±1.8
Widowed/divorced/separated/deceased	8.2±.4	3.3±1.4	17.9±14.5	10.7±9.4	4.3±1.6
First-born status					
No	62.2±.6	56.3±3.4	68.9±15.2	67.6±10.4	57.6±3.1
Yes	37.8±.6	43.7±3.4	31.1±15.2	32.4±10.4	42.4±3.1
Mother's age					
≤19 years	3.0±.3	1.2±1.0	.5±.7	.3±.6	1.1±.9
20–29 years	44.7±.7	30.4±3.3	59.5±12.3	57.0±10.9	33.5±3.1
≥30 years	52.4±.7	68.4±3.3	40.0±12.3	42.7±10.9	65.4±3.2
Household income					
>\$75,000	17.7±.4	24.7±2.6	7.3±3.6	15.7±7.9	23.4±2.4
Above poverty but ≤\$75,000	47.3±.7	41.0±3.3	62.6±10.6	48.6±11.5	42.3±3.1
Below poverty	22.8±.6	19.2±3.2	18.6±7.5	30.8±11.9	20.2±3.1
Unknown	12.2±.5	15.1±2.6	11.5±5.6	4.8±3.4	14.1±2.3
Facility type					
Only public	15.0±.5	10.1±2.4	9.4±5.1	16.8±10.5	10.6±2.3
Only private	61.2±.6	71.4±3.2	74.3±8.6	60.0±11.6	70.5±3.0
Mixed	7.7±.4	3.6±1.3	3.9±3.0	2.8±2.0	3.6±1.2
All others	16.1±.5	14.9±2.3	12.4±6.0	20.4±9.0	15.3±2.2
MSA status					
MSA, central city	35.5±.6	37.4±3.2	26.5±14.1	47.1±11.5	37.9±3.1
MSA, non-central city	46.4±.6	58.3±3.3	41.0±12.3	43.6±11.5	56.6±3.1
Non-MSA	18.1±.5	4.3±1.2	32.5±9.5	9.3±6.2	5.5±1.2
Number of providers					
0–1	69.5±.6	75.1±2.9	78.0±7.9	65.5±11.2	74.4±2.8
≥2	30.5±.6	24.9±2.9	22.0±7.9	34.5±11.2	25.6±2.8
Foreign-born status					
Yes	1.4±.2	3.4±1.4	.0±.0	2.3±2.2	3.2±1.3
No	98.6±.2	96.6±1.4	100±.0	97.7±2.2	96.8±1.3

\* Children in the 2002–2004 National Immunization Survey were born between January 1999 and July 2003.

† %± 95% confidence limit. Percentages are weighted.

‡ Asian and no other race.

§ Native Hawaiian and no other race.

|| Pacific Islander and no other race.

¶ Aggregate of Asian only, Native Hawaiian only, and Pacific Islander only groups.

mates that were lower than the total US estimates and those of the Asian only and Native Hawaiian only groups (Table 2).

For individual vaccines, children in the Native Hawaiian only group had higher vaccination coverage rates than

children in the Asian only and Pacific Islander only groups, except for 1+Var coverage, where Asian only children had higher coverage. The Native Hawaiian only group had significantly higher coverage for 3+HepB (95.6%, 95% CI 92.7%–98.5%;  $P<.05$ ), when compared

to those in the Asian only and Pacific Islander only groups. In contrast, Pacific Islander only children had significantly lower coverage for 4+DTP (73.9%, 95% CI 63.1%–84.7%;  $P<.05$ ) and the 4:3:1:3:3:1 series (60.7%, 95% CI 48.8%–72.6%;  $P<.05$ ).

Table 2. Estimated vaccination coverage with individual vaccines and selected vaccination series, United States, National Immunization Survey, 2002–2004\*

	3+DTP**	4+DTP††	3+Polio‡‡	1+MMR§§	3+Hib	3+HepB¶¶	1+Var***	3:3:1†††	4:3:1‡‡‡	4:3:1:3:3	4:3:1:3:3:1¶¶¶
US total†	95.7±3.3	84.3±5.5	91.3±4.4	92.7±4.4	93.6±3.3	91.7±4.4	84.4±5.5	87.9±4.4	81.6±5.5	78.6±6.6	71.6±6.6
Asian only‡	95.5±1.9	85.4±2.8	90.9±2.3	93.3±2.1	91.3±2.2	91.6±2.2	88.5±2.3	88.1±2.7	82.8±2.9	78.6±3.1	74.3±3.2
Native Hawaiian only§	97.7±2.0	88.1±5.0	93.9±3.3	94.6±3.5	96.3±2.7	95.6±2.9	85.6±6.6	92.3±3.8	86.2±5.5	84.5±5.8	76.8±8.1
Pacific Islander only	94.5±5.7	73.9±10.8	89.9±6.9	91.0±6.4	91.3±6.3	85.3±9.4	77.0±10.9	87.1±7.3	73.8±10.8	68.2±11.8	60.7±11.9
Asian only, Native Hawaiian only, and Pacific Islander only¶	95.5±1.8	84.6±2.7	90.9±2.1	93.1±1.9	91.4±2.0	91.2±2.1	87.5±2.3	88.1±2.5	82.1±2.8	77.9±2.9	73.2±3.0

\* Children in the 2002–2004 National Immunization Survey were born between January 1999 and July 2003.

† Percentage ± 95% confidence limit. Percentages are weighted.

‡ Asian and no other race.

§ Native Hawaiian and no other race.

|| Pacific Islander and no other race.

¶ Aggregate of Asian only, Native Hawaiian only, and Pacific Islander only groups.

\*\* Three or more doses of diphtheria and tetanus toxoids and pertussis vaccine.

†† Four or more doses of diphtheria and tetanus toxoids and pertussis vaccine.

‡‡ Three or more doses of poliovirus vaccine.

§§ One or more doses of measles-containing vaccine.

|| Three or more doses of *Haemophilus influenzae* type b vaccine.

¶¶ Three or more doses of hepatitis B vaccine.

\*\*\* One or more doses of varicella vaccine.

††† 3+DTP, 3+Polio, and 1+MMR.

‡‡‡ 4+DTP, 3+Polio, and 1+MMR.

§§§ 4:3:1 and 3+Hib.

||| 4:3:1:3 and 3+HepB.

¶¶¶ 4:3:1:3:3 and 1+Var.

*The findings in this study demonstrate that the routine aggregation of Asians and Pacific Islanders into one group may hide differences in health measures among the diverse Asian/Pacific Islander groups.*

## DISCUSSION

Assumption of the homogeneity of Asian/Pacific Islanders has resulted in a lack of knowledge of the health status and needs among individual ethnic/national/cultural groups.<sup>13</sup> The findings in this study demonstrate that the routine aggregation of Asians and Pacific Islanders into one group may hide differences in health measures among the diverse Asian/Pacific Islander groups.

For example, we found that vaccination coverage among Pacific Islander only children was lower than that of Asian only children, groups that are commonly aggregated together in public health research. Additionally, Native Hawaiian only children had higher vaccination coverage than Asian only children. These differences would have been lost if data for these race groups were combined.

Similar subgroup differences in immunization rates have also been reported among Hispanics. In a recent analysis that used NIS data, the rate of being up to date on vaccinations among Hispanic children differed significantly by state and selected cities, possibly reflecting more recent immigrants or state initiatives and policies that targeted this population.<sup>14</sup> Distinctions in race or ethnicity are evident for other health conditions as well. For example, among Pacific Islanders, Native Hawaiian and



Samoan women have a much higher prevalence of obesity than others in that ethnic group; among Asians, rates of hepatitis B infection vary widely, with higher rates among Southeast Asians;<sup>15</sup> and Filipino males have significantly higher mortality from cancer than Chinese and Japanese men.<sup>16</sup> These differences, as with the differences we found in childhood immunization rates among Asians and Pacific Islanders, may reflect diversity among subgroups in acculturation, social attitudes toward health care, access to health care, insurance coverage, or other social or economic characteristics.

Sample size is often the limiting factor in doing disaggregated analyses. While the number of people reporting Asian race is increasing, Asian/Pacific Islanders only accounted for 4.5% of the total US population in 2000. We were able to address this limitation by combining three years of NIS data (2002–2004), which resulted in information on 2673 Asian only, Native Hawaiian only, and Pacific Islander only children, 4.3% of the total sample size. However, even with this relatively large sample size, some confidence intervals were wide, limiting our ability to detect differences between groups. One possible consideration for future surveys among Asian and Pacific Islanders would be to oversample subgroups that are relatively small to obtain more accurate estimates.

This study is subject to at least two limitations. First, the NIS is a telephone survey, and although the data are weighted to account for households without a telephone, nonresponse, provider response propensity, and other factors, some bias may remain. Second, we assumed no secular trends existed among the variables used in the weighting methods for NIS; however, only

three years of data were combined, which would minimize this possible bias.

Although overall, the Asian/Pacific Islander group had higher childhood vaccination coverage than all US children, aggregated analyses would have missed differences among the individual groups, such as the lower coverage among Pacific Islanders. More research is needed to determine the causes of such differences. Future studies should collect demographic data to allow for more detailed examination of individual ethnic and national groups whenever possible. Our study highlights the need for public health research to examine the separate groups of Asian/Pacific Islanders to more accurately monitor and improve the health status of this growing population.

# REFERENCES

1. US Bureau of Census. The Asian population: 2000. Available at: <http://www.census.gov/prod/2002pubs/c2kbr01-16.pdf>. Accessed 5/3/06.
2. US Bureau of Census. The Native Hawaiian and other Pacific Islander population: 2000. Available at: <http://www.census.gov/prod/2001pubs/c2kbr01-14.pdf>. Accessed 5/3/06.
3. US Bureau of Census. Hispanic and Asian Americans increasing faster than overall population. Available at: <http://www.census.gov/Press-Release/www/releases/archives/race/001839.html>. Accessed 5/3/06.
4. White House Executive Order 13125. June 7, 1999. Available at <http://www.va.gov/dmeco/exec/13125.htm>. Accessed 5/3/06.
5. White House Executive Order 13216. June 6, 2001. Available at <http://www.whitehouse.gov/news/releases/2001/06/20010606-5.html>. Accessed 5/3/06.
6. Ghosh C. Healthy People 2010 and Asian Americans/Pacific Islanders: defining a baseline of information. *Am J Public Health*. 2003; 93:2093–2098.
7. Busch J, Easa D, Grandinett A, Mor J, Harrigan R. Healthy people in Hawaii?: an overview of ethnic health disparities in Hawaii for the Healthy People 2010 initiative targeted health concerns. *Hawaii Med J*. 2003;62: 10–14.
8. Yu SM, Huang ZJ, Singh GK. Health status and health services utilization among US Chinese, Asian Indian, Filipino, and other Asian/Pacific Islander children. *Pediatrics*. 2004;113:101–107.
9. Chen JY, Diamant AL, Kagawa-Singer M, Pourat N, Wold C. Disaggregating data on Asian and Pacific Islander women to assess cancer screening. *Am J Prev Med*. 2004;27: 139–145.
10. Esperat MC, Inouye J, Gonzalez EW, Owen DC, Feng D. Health disparities among Asian Americans and Pacific Islanders. *Ann Rev Nurs Res*. 2004;22:135–159.
11. Smith PJ, Battaglia MP, Huggins VJ, et al. Overview of the sampling design and statistical methods used in the National Immunization Survey. *Am J Prev Med*. 2001;20(4S):17–24.
12. Zell ER, Ezzati-Rice T, Battaglia MP. National Immunization Survey: the methodology of a vaccination surveillance system. *Public Health Rep*. 2000;115:65–77.
13. Srinivasan S, Guillermo T. Toward improved health: disaggregating Asian American and Native Hawaiian/Pacific Islander data. *Am J Public Health*. 2000;90:1731–1734.
14. Darling NJ, Barker LE, Shefer AM, Chu SY. Immunization coverage among Hispanic ancestry, 2003 National Immunization Survey. *Am J Prev Med*. 2005;29:421–427.
15. Health Problems in Asian American/Pacific Islander and Native Hawaiian Women. Available at: <http://www.4women.gov/minority/asianamerican/>. Accessed 5/3/06.
16. Lin SS, Clarke CA, Prehn AW, Glaser SL, West DW, O'Malley CD. Survival differences among Asian subpopulations in the United States after prostate, colorectal, breast and cervical carcinomas. *Cancer*. 2002;94:1175–1182.

# AUTHOR CONTRIBUTIONS

*Design concept of study:* Shaw, Santibanez, Chu  
*Acquisition of data:* Shaw, Santibanez  
*Data analysis and interpretation:* Shaw, Santibanez  
*Manuscript draft:* Shaw, Santibanez, Chu  
*Statistical expertise:* Shaw, Santibanez  
*Administrative, technical, or material assistance:* Shaw, Santibanez, Chu  
*Supervision:* Shaw, Santibanez, Chu