Further Analysis of National Participation *in the inactivated* Poliomyelitis Vaccination Program, 1955-61

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A MEASURE of the acceptance of inactivated poliomyelitis vaccine by various population segments is important both to those concerned with its effective community application and to those concerned with the continuing measurement of its effectiveness. A substantial body of data relating to the acceptance of inactivated poliomyelitis vaccine has been obtained annually since 1957 through the Current Population Survey conducted by the Bureau of the Census. An analysis of this data by age group alone has been presented by Sirken (*1*).

Utilizing information from the same source, this paper supplements Sirken's presentation with a more extensive analysis of the data by a number of other variables, including age and sex, age and race, geographic region, geographic division, type of area (urban or rural), and income.

Although some observations concerning motivational factors are made, the primary purpose is to describe the extent of participation. The sociological and motivational factors affecting this participation have been well recorded in the literature (*2–10*).

Study Methods

Trend statistics in this report are based on five national household surveys conducted annually since 1957. These surveys were sponsored by the Public Health Service and conducted by the Bureau of the Census as supplements to its monthly Current Population Survey which includes 35,000 households. A description of the Current Population Survey has already appeared (*11*). Additional details concerning the Current Population Survey methods and sample design were included in a report based on the 1957 survey (*12*).

The reliability of the estimated percentages derived from these annual surveys is discussed in the statistical note appearing on p. 479. The final table contains the approximate standard errors of estimated percentages, computed for selected sizes of the population base, which may be used to make tests of differences between two percentages.

Definitions

The Current Population Survey covers the civilian noninstitutional population. Consequently, the Armed Forces and persons residing in institutions are excluded from estimates in this report. The variables used in the study are defined as follows:

Age. The age classification was based on the age of the person at his last birthday.

Race. Persons were classified as white or nonwhite in accordance with the U.S. Bureau of the Census definitions (*13*).

Geographic region and division. The four geographic regions and nine divisions are those

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defined by the U.S. Bureau of the Census (*14*) (fig. 1).

Type of area. Persons were classified as living in either (*a*) a Standard Metropolitan Area (SMA), (*b*) an urban area, or (*c*) a rural area. The definitions of SMA, urban, and rural are those used in the 1950 census (*15*).

Except in New England, a Standard Metropolitan Area is a county or group of contiguous counties which contains at least one city of 50,000 inhabitants or more. In addition to the county or counties containing such a city or cities, contiguous counties are included in a Standard Metropolitan Area if, according to certain criteria, they are essentially metropolitan in character and socially and economically integrated with the central city. In New England, Standard Metropolitan Areas have been assigned on a town rather than a county basis and are defined in terms of population density.

Areas not included in an SMA may be either urban or rural. Urban areas are as follows: (*a*) places of 2,500 inhabitants or more incorporated as cities, boroughs, and villages; (*b*) incorporated towns of 2,500 inhabitants or more except in New England, New York, and Wisconsin, where towns are simply minor civil divisions of counties; (*c*) the densely settled urban fringe,

Figure 2. Percent of persons receiving three or more inoculations of inactivated poliomyelitis vaccine by age and sex, September 1957 and 1961

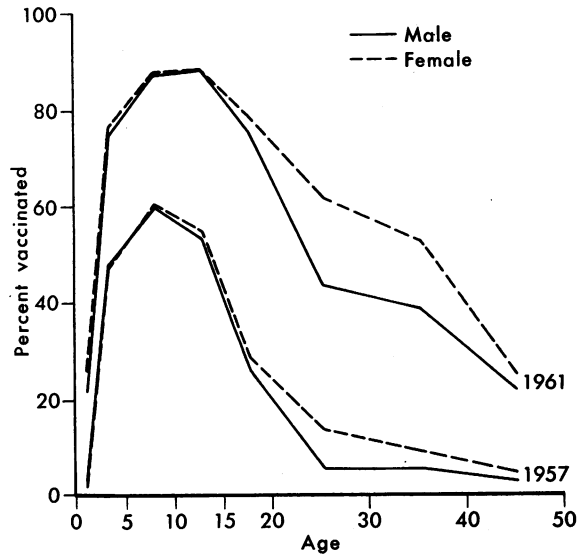
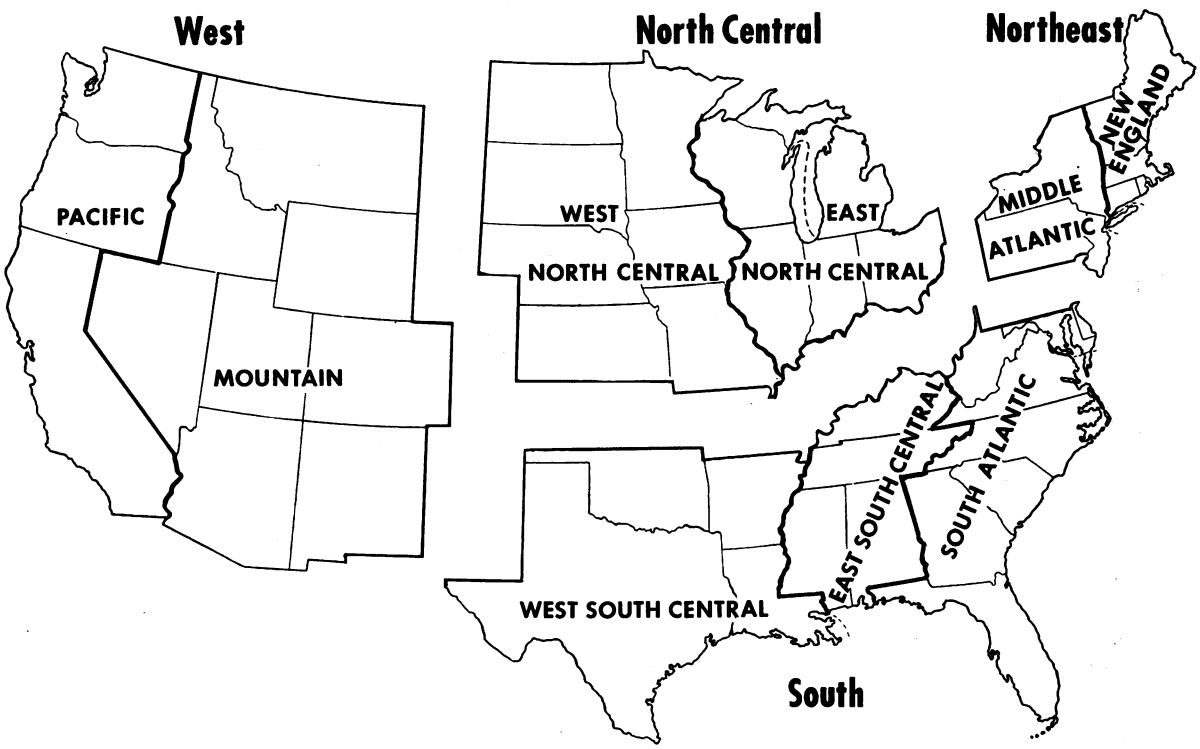


Figure 1. Nine geographic divisions of the United States



including both incorporated and unincorporated areas, around cities of 50,000 or more; and (*d*) unincorporated places of 2,500 inhabitants or more outside any urban fringe. The remaining areas are classified as rural.

Family income. This variable was used only in the 1957 survey. Persons in primary families (heads of households and household members related to the head of the household) were classified according to family income for the preceding 12 months.

Vaccination status. Persons were classified as having received none, one, two, three, or four or more poliomyelitis vaccine inoculations. For the purpose of this report, any person with three or more doses of inactivated vaccine will be considered a triply vaccinated or vaccinated person, and the fourth dose may sometimes be referred to as a booster inoculation.

Survey period. The 1957 survey was conducted in August and the 1958, 1959, 1960, and 1961 surveys in September. For comparison, the month of September is used as a reference point for the 1957 survey in some graphs.

Results

Age and sex. The vaccination status of the population by sex was obtained in the 1957, 1960, and 1961 surveys. By September 1961, more than 85 percent of all school age (5–14 years) boys and girls had received at least three doses of inactivated poliomyelitis vaccine, and about 60 percent had received four or more doses. The percentage of males and females receiving three or more inoculations of inactivated vaccine is presented in figure 2 by age group for the years 1957 and 1961.

Table 1. Poliomyelitis vaccination status of the civilian noninstitutional population under 60 years by age and sex, United States, September 1961

Age and sex	Population category (millions)[1]	Percent distribution by number of inoculations				
		0	1	2	3	4 or more
Total under 60 years:						
Male	50	40.2	2.6	5.8	20.9	30.4
Female	50	35.4	2.7	6.1	22.5	33.3
Under 1 year:						
Male	2	46.3	12.7	19.9	17.9	3.2
Female	2	43.7	13.5	17.6	21.6	3.6
1–4 years:						
Male	10	13.6	3.7	9.4	31.3	42.0
Female	10	12.1	3.7	8.9	33.4	42.0
5–9 years:						
Male	10	7.0	2.0	4.7	24.9	61.5
Female	10	6.3	2.1	4.9	24.9	61.8
10–14 years:						
Male	10	6.2	1.9	4.5	29.5	57.9
Female	10	6.7	1.3	4.6	29.1	58.3
15–19 years:						
Male	5	17.7	1.9	5.6	32.6	42.4
Female	5	13.9	1.9	6.2	32.4	45.6
20–29 years:						
Male	10	47.1	2.8	7.4	21.0	21.7
Female	10	27.1	3.1	8.9	27.4	33.4
30–39 years:						
Male	10	52.8	3.1	6.4	19.0	18.7
Female	10	38.1	3.1	7.2	22.6	29.0
40–49 years:						
Male	10	73.3	2.0	4.0	10.9	9.8
Female	10	69.4	2.7	4.2	12.5	11.3
50–59 years:						
Male	10	89.8	1.2	1.6	4.5	3.0
Female	10	89.8	1.0	1.8	4.5	2.9

[1] The estimated population size for each age group has been independently rounded to the nearest population size given in table 6; hence the sum of parts shown may differ slightly from the totals shown. Percentages are based on unrounded numbers.

In 1957, the children 5 to 9 years of age represented the best vaccinated group for either males or females. This was probably the direct result of the vaccine allocation system recommended on May 16, 1955, when priority was given to children aged 5–9, and each State was allocated vaccine in proportion to its population in that age group. In 1961, slightly more of those 10 to 14 years of age were vaccinated than those 5 to 9 years old.

In both 1957 and 1961, there was no difference in the proportion of vaccinated males and vaccinated females under 20 years of age. However, among adults, significantly more women than men were vaccinated in 1957 and 1961 in each of the adult age groups.

In all age groups under 20 years, the percentage of males and females with exactly three doses of vaccine in 1961 was essentially equal (table 1). This was similarly true for four or more doses of vaccine. A greater proportion of the vaccinated children, 1 through 19 years, of both sexes had received four or more doses than three doses. However, among adults 20 to 39 years of age, a greater percentage of women than men had received their fourth inoculation.

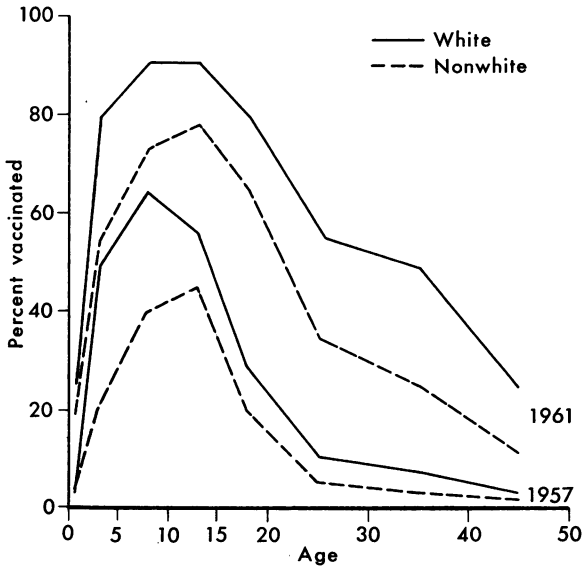
Race. A greater proportion of white persons than nonwhite have received three or more inoculations of inactivated poliomyelitis vaccine. By September 1961 (table 2), 55 percent of the white population under 60 years of age had received three or more doses of vaccine compared with 43 percent of the nonwhite population. There was a significant difference for all age groups with the exception of infants under 1 year of age. For persons under 20 years, the proportion triply vaccinated was 81

Table 2. Poliomyelitis vaccination status of the civilian noninstitutional population under 60 years, by age and ethnic group, United States, September 1961

Age and ethnic group	Population category (millions)[1]	Percent distribution by number of inoculations				
		0	1	2	3	4 or more
Total under 60 years:						
White	50	36.8	2.4	5.7	21.6	33.6
Nonwhite	20	44.9	4.5	8.0	23.1	19.5
Under 1 year:						
White	4	43.5	12.9	19.5	20.5	3.5
Nonwhite	.5	53.5	14.1	14.3	15.1	2.9
1–4 years:						
White	15	10.5	3.0	8.4	32.6	45.5
Nonwhite	3	26.1	7.7	13.5	30.5	22.2
5–9 years:						
White	15	5.6	1.4	3.9	23.3	65.8
Nonwhite	3	12.7	5.6	10.1	34.3	37.2
10–14 years:						
White	15	5.6	1.3	4.0	28.0	61.0
Nonwhite	2	11.8	3.6	8.0	37.4	39.2
15–19 years:						
White	10	14.4	1.7	5.6	31.8	46.4
Nonwhite	2	25.1	3.2	8.2	37.5	26.0
20–29 years:						
White	20	33.7	2.9	8.2	25.2	29.9
Nonwhite	3	55.3	3.5	8.0	19.0	14.2
30–39 years:						
White	20	42.7	3.0	6.8	21.6	26.0
Nonwhite	3	65.3	4.0	6.9	15.1	8.8
40–49 years:						
White	20	70.0	2.3	4.1	12.4	11.2
Nonwhite	2	83.1	2.8	3.5	6.0	4.6
50–59 years:						
White	15	89.6	1.0	1.7	4.6	3.1
Nonwhite	2	92.1	1.7	2.0	3.0	1.2

[1] See footnote to table 1.

Figure 3. Percent of persons receiving three or more inoculations of inactivated poliomyelitis vaccine by age and ethnic group, September 1957 and 1961



percent for white persons and 64 percent for nonwhite. At ages 20–59 years, 34 percent of the white population had been vaccinated compared with 20 percent of the nonwhite population.

This race differential for both the younger and older age groups was evident in the 1957 survey (*12*) and has continued throughout recent years (fig. 3). From 1957 to 1960, the increase in percentage of persons vaccinated was approximately equal for whites and nonwhites under 15 years of age. However, among adults, the vaccinated white population increased at a faster rate, producing the greater difference seen among adults in 1961.

During the 1960 to 1961 interval, the proportion of the nonwhite population vaccinated increased slightly more than the white population for all age groups under 40 years. This change was caused largely by nonwhite children and adults receiving their third inoculation for the first time between 1960 and 1961 while the white population had been receiving the fourth and, in some instances, fifth inoculation. Those receiving a fifth dose would not increase the percentage of persons with three or more inoculations.

The white population 1 through 39 years had received a greater proportion of fourth doses of vaccine than third doses (table 2). However, in the nonwhite population, this is true only for school-age children, and even in this group the difference is not outstanding.

Geographic regions. The proportion of persons who had received three or more doses of vaccine by September 1957 did not vary greatly between the four geographic regions of the United States (Northeast, North Central, South, and West). The variation between regions ranged from 27 percent for the North Central region to 23 percent for the South (*12*).

In September 1960, 3 years later, the West had the highest proportion of triply vaccinated persons, 55 percent with three or more doses of vaccine. The proportion triply vaccinated in the North Central and Northeast regions was virtually the same, 53 percent and 51 percent, respectively. The proportion vaccinated in the South was 47 percent, the lowest of the four regions. There is a clear differential between the West and South, and a difference is also noted between the other regions and the South.

The Northeast region, followed closely by the North Central and Western regions, had the highest proportion of vaccinees among children (table 3). Among adults, the participation was comparatively equal among all regions except the South. The South had the lowest proportion of vaccinees for all four age groups shown.

For all regions, only the school-age population had received a greater proportion of fourth doses of vaccine than third doses (table 3). This finding is consistent with the school-age children becoming the first group to receive three doses of vaccine and then being the first group eligible for a booster dose when this was recommended in 1959. Among preschool children (0–4 years of age), about 40 percent had not yet received their third dose of vaccine, and as many as 24 percent of the preschool children in the South were still unvaccinated.

The proportion of persons triply vaccinated by region and type of area was also tabulated in 1960. For children under 15 years of age, all regions except the West had a higher proportion vaccinated in the Standard Metropolitan Areas than in urban and rural areas. These differences were greatest for the children under

5 years of age. This differential was greatest in the South where 62 percent of the preschool children in the SMA's were vaccinated compared with 51 percent of those in urban and rural areas.

Among adults, only the South and North Central regions exhibited a greater proportion of persons in the SMA's triply vaccinated. The differences were not great for adults in any region.

The proportion of persons triply vaccinated by region and race was tabulated in the 1959 survey. In all regions and age groups, a greater proportion of the white population had been vaccinated. For persons under 20 years of age, the greatest difference was in the West where 71 percent of the white population had been vaccinated as compared with 44 percent of the nonwhite population. Among adults, the greatest difference was found in the North Central region where 43 percent of the white population were vaccinated compared with 18 percent of the nonwhite population.

Geographic divisions. Results from the 1957 survey showed differences among the geographic divisions within each region to be smaller than those among regions (*12*). In 1960, the geographic divisions comprising the Northeast and Southern regions did show some differences (table 4).

In the Northeast region, the New England States showed a greater proportion of persons vaccinated in all age groups than the Middle Atlantic States. This difference was especially true among adults. When the persons who had received four or more doses of vaccine are considered, there is a highly significant difference at all age groups. This may be attributed to some extent to the 1960 poliomyelitis epidemic in Rhode Island. During the epidemic season of 1960, from June through September, approximately 500,000 doses of vaccine were distributed, the greatest proportion in July (*16*). It is also estimated that 43 percent of the Salk vaccine administered to the population of Providence, R.I., during June, July, and August went

Table 3. Poliomyelitis vaccination status of the civilian noninstitutional population under 60 years by age and geographic region, United States, September 1960

Age and geographic region	Population category (millions)[1]	Percent distribution by number of inoculations				
		0	1	2	3	4 or more
Total under 60 years:						
Northeast	40	39.7	2.8	6.6	24.5	26.3
North Central	40	38.8	2.3	6.4	26.2	26.3
South	50	44.0	2.8	6.5	25.0	21.9
West	25	35.7	3.7	8.5	27.4	27.7
0–4 years:						
Northeast	5	16.8	4.9	12.5	33.0	32.7
North Central	5	18.5	4.9	12.4	36.2	28.1
South	5	24.2	5.9	13.0	30.5	26.4
West	3	17.2	6.1	14.7	36.3	25.7
5–14 years:						
Northeast	10	4.4	1.4	4.4	33.4	56.4
North Central	10	6.9	1.8	5.0	34.3	51.9
South	10	10.0	2.8	6.8	37.8	42.7
West	5	7.6	2.3	7.1	36.3	46.7
15–39 years:						
Northeast	15	35.9	3.2	8.2	29.3	23.4
North Central	15	35.5	2.3	7.8	30.1	24.3
South	20	45.3	2.7	6.8	26.7	18.5
West	10	32.4	4.5	9.9	30.6	22.6
40–59 years:						
Northeast	10	82.0	2.4	3.6	7.5	4.5
North Central	10	82.3	1.4	2.6	8.6	5.1
South	10	88.1	1.0	1.8	5.9	3.2
West	5	77.3	2.9	4.4	9.4	6.0

[1] See footnote to table 1.

to persons receiving their fourth, fifth, sixth, and seventh doses (*17*).

In the southern region, there was a greater proportion of vaccinated persons in the West South Central division. This was especially true among preschool age children and the 15- to 39-year age group. A significantly higher proportion of individuals in this division had reached their fourth inoculation compared with the East South Central and South Atlantic States.

In all age groups, the New England States had the highest proportion of persons vaccinated.

Table 4. Poliomyelitis vaccination status of the civilian noninstitutional population under 60 years, by age and geographic division, United States, September 1960

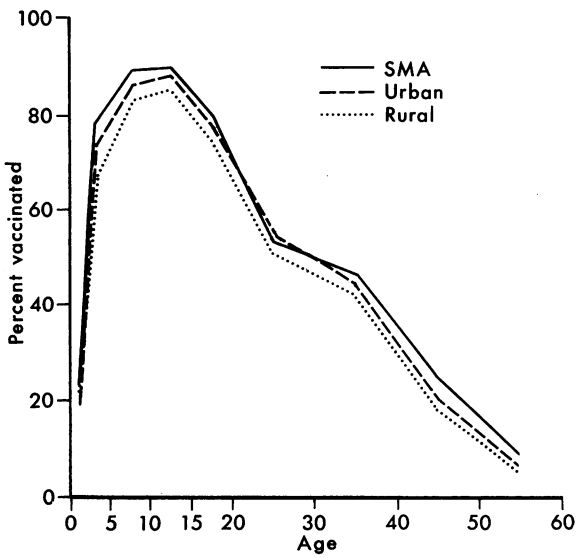
Age and geographic division	Population category (millions)[1]	Percent distribution by number of inoculations				
		0	1	2	3	4 or more
Total under 60 years:						
New England	10	32.1	2.9	7.4	22.9	34.7
Middle Atlantic	30	42.1	2.7	6.4	25.0	23.7
East North Central	30	39.4	2.4	6.7	26.0	25.5
West North Central	10	37.3	2.0	5.6	26.7	28.5
South Atlantic	20	45.8	3.0	6.5	25.5	19.2
East South Central	10	47.8	2.4	6.5	25.6	17.7
West South Central	15	39.4	2.7	6.4	23.9	27.5
Mountain	5	37.6	2.6	6.9	27.3	25.6
Pacific	20	35.0	4.1	9.0	27.4	24.4
0–4 years:						
New England	1	15.3	3.6	14.0	27.1	40.0
Middle Atlantic	3	17.4	5.4	12.0	35.1	30.1
East North Central	4	18.3	5.2	12.9	35.2	28.4
West North Central	1	18.9	3.9	11.0	38.9	27.2
South Atlantic	3	24.3	7.7	14.5	31.6	21.9
East South Central	2	28.6	5.3	13.5	30.9	21.7
West South Central	3	21.9	4.4	11.3	29.3	33.1
Mountain	1	16.6	6.4	13.0	40.6	23.3
Pacific	2	17.4	6.0	15.4	34.5	26.7
5–14 years:						
New England	2	2.8	1.0	3.1	25.8	67.4
Middle Atlantic	5	5.0	1.5	4.8	36.0	52.7
East North Central	5	6.7	1.9	5.3	35.0	51.1
West North Central	3	7.5	1.6	4.3	32.8	53.9
South Atlantic	5	8.8	3.0	7.4	41.1	39.7
East South Central	3	11.8	2.8	7.4	43.8	34.1
West South Central	4	10.1	2.5	5.8	29.9	51.6
Mountain	2	7.8	2.4	5.1	35.2	49.6
Pacific	4	7.5	2.3	7.9	36.7	45.7
15–39 years:						
New England	3	25.4	3.8	9.2	28.6	33.0
Middle Atlantic	10	39.1	3.0	7.9	29.5	20.5
East North Central	10	36.8	2.5	8.1	29.7	22.9
West North Central	4	32.0	2.0	6.7	31.2	28.1
South Atlantic	10	47.9	2.8	6.6	26.7	16.0
East South Central	4	49.6	1.9	7.0	25.8	15.8
West South Central	5	39.8	3.0	7.0	27.4	22.8
Mountain	2	35.3	2.1	8.6	29.7	24.3
Pacific	5	31.5	5.2	10.3	30.9	22.0
40–59 years:						
New England	2	74.0	3.1	5.1	10.7	7.2
Middle Atlantic	10	84.4	2.1	3.2	6.6	3.7
East North Central	10	82.9	1.4	2.6	8.3	4.8
West North Central	3	80.6	1.3	2.9	9.3	5.9
South Atlantic	5	88.3	.9	1.8	6.0	3.0
East South Central	3	92.7	.9	1.0	3.8	1.5
West South Central	4	84.4	1.2	2.5	7.2	4.7
Mountain	2	82.6	1.4	2.7	8.1	5.1
Pacific	5	75.4	3.4	5.0	9.9	6.3

[1] See footnote to table 1.

Type of area. The proportion of persons under 60 years of age who had received three or more doses of vaccine was slightly greater in Standard Metropolitan Areas than in urban or rural areas (fig. 4). The proportion vaccinated was 55 percent for SMA's compared with 52 percent for urban and 51 percent for rural places. In general, the differences between the three types of areas are somewhat greater when age is held constant. For each age group, residence in the Standard Metropolitan Areas corresponded to the greatest participation in the vaccine program. This was true for 1957, 1960, and 1961.

The vaccination status by age and type of area is tabulated in table 5 for September 1961. For each age group from 1 through 39 years, and in each type of area, more than half of the persons with three or more doses of vaccine had already received their fourth dose. This response to the fourth or booster inoculation, recommended in 1959, was not evident in any great degree until the 1961 survey. Through 1960, only those from 1 through 14 years in the SMA and the urban areas had received a greater proportion of fourth doses than third doses. In the rural areas, only those vaccinees from 1 through 9 years had received a greater proportion of booster inoculations.

Figure 4. Percent of persons receiving three or more inoculations of inactivated poliomyelitis vaccine by age and type of area, September 1961



Family income. The participation of persons by income and selective population characteristics was tabulated only in the 1957 survey (*12*). Participation in the vaccination program was strongly associated with family income. This association between participation and income held for each geographic region and area of residence. The relationship was much more marked for the white population than for the nonwhite population; in fact, among nonwhite children of school age, participation was not correlated with family income. Persons and families with a yearly income less than $3,000 received most of their inoculations at work or school. Those in higher income families received most of their inoculations from private physicians.

Other surveys measuring levels of vaccination by socioeconomic status have been conducted since 1957 (*18*, *19*). In these, the highest levels of vaccination status have been associated with the upper socioeconomic groups.

Discussion

It is clearly evident that well-defined segments of the population have not participated in the poliomyelitis (inactivated) vaccination program as well as others. The response of adult males, preschool children, and the nonwhite population has been well below the participation of adult females, school-age children, and the white population.

The higher rate of vaccination among females undoubtedly reflects the fact that pregnant women were one of the more important target groups in the vaccination program. In addition, the mothers were available for vaccination when they brought their children to the physicians' offices and clinics for inoculations.

During the 5-year period 1957–61, the difference between vaccinated men and women grew larger, as the following figures show.

	Percent vaccinated		
	1957	*1960*	*1961*
20–29 years:			
Men	4.6	39.3	42.7
Women	12.7	58.0	60.8
30–39 years:			
Men	4.6	35.1	37.7
Women	8.0	46.3	51.6

As a result of this widening difference, the Surgeon General's Committee on Poliomyelitis Control in January 1961 laid the groundwork for a "Babies and Breadwinners" poliomyelitis vaccination campaign (*20*). This proposal was aimed at unvaccinated men and the preschool children who have never attained the degree of vaccination that the captive school population has. Although the vaccination status of men has improved slightly from 1960 to 1961, the relative proportions of vaccinated men and women has not changed.

The better vaccination status of women has altered the epidemiologic pattern of paralytic poliomyelitis among adults. In 1955, the last year before widespread immunization with inactivated poliomyelitis vaccine, women between ages 20 and 39 experienced higher attack rates than men in the same age group (*21*). Before widespread immunization, women were probably at greater risk than men because of closer contact with infants and young children. During 1960, in contrast to 1955, the age-specific attack rates were higher for men than women in this 20- to 39-year-age group (*22*).

It is notable that 13 percent of the preschool

Table 5. Poliomyelitis vaccination status of the civilian noninstitutional population under 60 years, by age and type of area, United States, September 1961

Age and type of area	Population category (millions) [1]	Percent distribution by number of inoculations				
		0	1	2	3	4 or more
Total under 60 years:						
SMA	50	36.4	2.7	6.0	21.2	33.7
Urban	20	39.3	2.3	6.0	22.2	30.2
Rural	40	40.1	2.6	5.7	22.7	28.8
Under 1 year:						
SMA	3	42.3	13.5	19.2	20.9	4.0
Urban	.5	44.8	13.3	22.5	17.1	2.4
Rural	1	50.0	12.2	16.5	18.6	2.7
1–4 years:						
SMA	10	10.1	3.4	8.6	31.3	46.6
Urban	2	15.6	2.6	8.8	35.8	37.3
Rural	5	17.2	4.7	10.5	32.9	34.7
5–9 years:						
SMA	10	5.2	2.0	4.1	23.1	65.7
Urban	2	7.4	1.6	5.4	25.4	60.3
Rural	5	9.1	2.4	5.9	28.1	54.4
10–14 years:						
SMA	10	5.2	1.5	4.2	26.8	62.3
Urban	2	6.6	1.0	4.8	31.8	55.7
Rural	5	8.6	2.2	4.9	32.7	51.5
15–19 years:						
SMA	5	14.4	1.6	6.1	31.0	47.0
Urban	2	14.3	2.4	6.2	33.2	43.9
Rural	4	18.9	2.4	5.5	35.1	38.1
20–29 years:						
SMA	15	34.9	3.1	8.9	24.0	29.1
Urban	3	35.7	2.5	7.9	26.9	27.0
Rural	5	40.4	2.8	6.8	24.3	25.7
30–39 years:						
SMA	15	42.7	3.3	7.2	21.4	25.5
Urban	3	47.0	3.0	6.3	21.2	22.5
Rural	5	50.5	2.7	6.0	19.6	21.3
40–49 years:						
SMA	15	67.9	2.8	4.6	13.1	11.6
Urban	3	74.2	1.9	3.8	9.0	11.1
Rural	5	77.7	1.4	3.0	9.8	8.0
50–59 years:						
SMA	10	88.1	1.3	2.0	5.2	3.5
Urban	2	90.5	1.3	1.9	4.0	2.3
Rural	5	93.3	.5	1.0	3.1	2.1

[1] See footnote to table 1.

children (1 through 4 years) and 45 percent of the infants under 1 year were still unvaccinated in September 1961. During the 4-year period 1958–61, an average of 43 percent of the paralytic cases of poliomyelitis were in preschool-age children and an average of 63 percent of all cases in this age group had received no inactivated vaccine (*23*).

The results of the September 1962 survey show that this situation is not being remedied (*24*). As of that date, 14 percent of the preschool children and 50 percent of the infants under 1 year were still unvaccinated.

The problem in reaching preschool children is evident once again when looking at the greater proportion of white population vaccinated compared with the nonwhite population. Twenty-six percent of the nonwhite preschool children were unvaccinated along with 11 percent of the white preschool children. In addition, roughly half of the white and nonwhite infants under 1 year of age were also unvaccinated.

Since the advent of inactivated vaccine, it has been well documented that urban epidemics have produced higher attack rates of paralytic poliomyelitis among the nonwhite than among the white population (*25–29*). It is suggested that this change in the epidemiologic pattern of paralytic poliomyelitis can in large part be attributed to the difference in vaccination levels of the two populations under discussion.

Estimates of the effectiveness of three or more doses of inactivated poliomyelitis vaccine, as studied in four recent epidemics, have ranged from 77 to 82 percent (*16, 28, 30*). The sharp drop in poliomyelitis incidence since 1955 can be attributed largely to the use of the inactivated vaccine. The reason that the decrease in paralytic poliomyelitis has not been greater may be the poor immunization status of the aforementioned population groups.

Summary

Since 1957 the Public Health Service has sponsored annual surveys to determine nationwide participation in the inactivated poliomyelitis vaccination program which began in April 1955. These vaccination surveys were conducted in 5 successive years by the Bureau of the Census as supplements to the monthly Current Population Surveys.

The significant results of the five surveys were analyzed according to various segments of the population. The proportion of the population adequately immunized has progressively increased since the licensure of Salk vaccine in April 1955. By September 1961, 77 percent of the population under 40 years of age had received at least one inoculation, about 67 percent had received three or more inoculations, and 40 percent had received the fourth or booster inoc-

Table 6. Sampling variability of estimated percentages

Population base of the percentage	Standard error of estimated percentages[1]								
	2 or 98	5 or 95	10 or 90	15 or 85	20 or 80	25 or 75	30 or 70	40 or 60	50
250,000	1.5	2.3	3.2	3.8	4.2	4.6	4.8	5.2	5.3
500,000	1.0	1.6	2.2	2.7	3.0	3.2	3.4	3.6	3.7
1,000,000	.7	1.2	1.6	1.9	2.1	2.3	2.4	2.6	2.6
2,000,000	.5	.8	1.1	1.3	1.5	1.6	1.7	1.8	1.9
3,000,000	.4	.7	.9	1.1	1.2	1.3	1.4	1.5	1.5
4,000,000	.4	.6	.8	.9	1.1	1.1	1.2	1.3	1.3
5,000,000	.3	.5	.7	.8	.9	1.0	1.1	1.2	1.2
10,000,000	.2	.4	.5	.6	.7	.7	.8	.8	.8
15,000,000	.2	.3	.4	.5	.5	.6	.6	.7	.7
20,000,000	.2	.3	.4	.4	.5	.5	.5	.6	.6
25,000,000	.1	.2	.3	.4	.4	.5	.5	.5	.5
30,000,000	.1	.2	.3	.3	.4	.4	.4	.5	.5
40,000,000	.1	.2	.2	.3	.3	.4	.4	.4	.4
50,000,000	.1	.2	.2	.3	.3	.3	.3	.4	.4

[1] The chances are 67 out of 100 that the true percentage is within plus and minus the standard error, and 95 out of 100 that it is within plus and minus twice the standard error.

ulation. Approximately 60 percent of school-age children had four or more doses of inactivated poliomyelitis vaccine by September 1961, but less than half of the preschool children and young adults and less than one-quarter of the men had reached this level.

In summary, the response of preschool children, adult males, and lower socioeconomic groups has been well below the participation of school-age children, adult females, and higher socioeconomic groups respectively. Since the advent of the inactivated poliomyelitis vaccine in 1955, poliomyelitis has attacked these poorly immunized groups with greater frequency.

Estimates of the effectiveness of three or more doses of inactivated poliomyelitis vaccine, as studied in four recent epidemics, have ranged from 77 to 82 percent. The sharp drop in poliomyelitis incidence since 1955 can largely be attributed to the use of the inactivated vaccine. That the decrease in paralytic poliomyelitis has not been greater may be attributed to the population groups who have remained poorly immunized.

Therefore, outbreaks of poliomyelitis will continue unless more extensive vaccination is carried out in preschool children, adult males, and lower socioeconomic groups.

STATISTICAL NOTE

In this paper, the statistics are expressed principally as percentages of the population that received three or more doses of inactivated poliomyelitis vaccine. Since these statistics are based on a sample, they are subject to sampling variation. Although the sampling variation of the Current Population Survey was fully discussed in the report of the 1957 survey results (*12*), the more important details are repeated here for clarity and convenience.

Table 6 presents the approximate standard errors of estimated percentages computed for selected sizes of the population base. Estimates of sampling error presented in table 6 depend on both the size of the percentage and the size of the age group on which it is based. The chances are 67 out of 100 that the percentage based on a complete enumeration of the population group would be within the interval represented by the estimated percentage plus and minus the standard error of the estimate.

These errors pertain to the estimates derived from the 1957, 1960, and 1961 surveys, each of which utilized the entire monthly Current Population Survey sample of 35,000 households. The 1958 and 1959 estimates were based on information from a subsample of one-half the 35,000 households in the Current Population Survey sample. The sampling errors for these estimates are roughly 40 to 50 percent larger than the errors shown in table 6.

In addition to sampling variation, the estimates in this report are subject to nonsampling errors such as those caused by nonresponse and to response bias. The existing evidence, however, does not indicate that these measuring errors materially affect the data. The population willingly cooperated in providing the information in the household interviews, and with few exceptions (less than 1 percent), the respondents were able to report the number of inoculations received.

Table 6 can be used to make rough significance tests of differences between two percentages. Assuming the correlation between the two percentages to be negligible, the standard error of the difference between the two percentages is equal to the square root of the sum of the squared standard errors of each percentage. Thus, if the difference between the two percentages is more than twice its sampling error, or more than three times if a more conservative test is desired, the difference is considered significant. In this paper, the more conservative test of three times the error has been used.

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Resources for Mentally Ill Children

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