

Determining Level of Immunization to Poliomyelitis

H. BARRETT BOCK, M.S., CHARLES R. HAYMAN, M.D., M.P.H., and CRAIG TURNBULL, B.S.

THE METHODS used for determining the level of immunization to poliomyelitis in a community have recently been reviewed (1). A registration method for all persons who came to the Sabin vaccine clinics in Berks County, Pa., January to June 1963, has been described in detail in a previous article (2). Serfling and associates have described procedures for determining community immunization levels by interviewing persons in a sample of households (3, 4). The sample survey method has been widely used, but, to our knowledge, no publication directly compares this method with a registration method.

The 1963 registration method consisted of entering on a preprinted card the name, address, age, sex, previous Salk experience, clinic location, date, and type of Sabin vaccine being given at the time the person first registered in the Sabin program. Different colored cards were used at each of the three phases of the program. Appointment slips were given after vaccination. These slips were collected before each additional vaccination and matched, by name, to the original registration card. The type of Sabin vaccine was transcribed on the original card, and at the end of the program these cards were coded for residence and number of doses and machine-processed for tabulations.

Mr. Bock is the director and Mr. Turnbull is a statistician, division of biostatistics, department of health, Commonwealth of Pennsylvania. Dr. Hayman was medical director of region VI, Pennsylvania Department of Health, and is now associate director for preventive services, department of health, District of Columbia.

In June 1964, 1 year after the Berks County oral poliomyelitis vaccination program, a sample survey of the county was conducted in which information was obtained on the Salk and Sabin vaccinations. The purposes of the survey were (a) to compare the findings obtained by the survey with those previously obtained by the registration method, and (b) to compare the costs in time and money.

Methodology

The survey was set up on the basis of a random sampling of households throughout the county. City blocks within census tracts were used as primary sampling units in the city of Reading, Pa. Eight households in each block selected for sampling were chosen for interview. A grid-intersection method was used in the remainder of the county, and four dwelling units at each intersection were selected for interview.

Twenty interviewers were recruited from the county, regional, and central office staffs. These consisted of six public health nurses, four sanitarians, four venereal disease investigators, three industrial hygienists, one chronic disease representative, one medical social worker, and one medical student. In a 2-hour session, all were oriented by the survey coordinator to the purposes and procedures of the survey. Team members initially visited the households selected and interviewed the families. Male interviewers made night callbacks when necessary. The coordinator, three clerks, and three volunteers made the telephone callbacks.

Eight hundred and forty households were scheduled for interview in the survey. Of the

840 households visited, 743 interviews were completed on the first visit (table 1). Only 1.3 percent of the interviews scheduled for households were not completed. The survey was accomplished in 3 working days. Each housing unit family was interviewed to obtain data on age and sex and immunization status with the Salk and Sabin vaccines. The other household and immunization information obtained was included in an unpublished report to the Berks County Medical Society.

Findings

Information on personal characteristics and immunization status with the Salk and Sabin vaccines was obtained on 2,736 persons in 829 households. This was a 1 percent sample of the 275,414 persons residing in the county, according to the 1960 census. The age distribution of the survey sample is compared with the 1960 census data in table 2.

The following question was asked in the sur-

Table 1. Number of households visited in 1964 survey and percentage of interviews completed, Berks County, Pa.

Family interviews	Number households visited	Interviews completed (percent)
Total.....	840	100
Completed on first visit.....	743	88.5
Completed on revisit.....	37	4.4
Completed by telephone call-back.....	49	5.8
Not obtained:		
Not at home.....	7	.8
Refusal.....	4	.5

Table 2. Percent distribution of population, by selected age groups, 1960 census and 1964 survey, Berks County, Pa.

Age group (years)	1960 census	1964 survey
Under 6.....	11.1	11.5
6-9.....	6.9	7.5
10-14.....	8.3	8.4
15-17.....	4.2	5.9
18-34.....	20.1	18.6
35-64.....	38.2	36.3
Over 64.....	11.2	11.8

Table 3. Percent attendance at Sabin vaccine clinics, by selected age groups, as determined by 1964 survey and 1963 registration, Berks County, Pa.

Age group (years)	1964 survey	1963 registration
All ages.....	100.0	100.0
Under 6.....	12.1	13.9
6-9.....	10.4	11.0
10-14.....	13.0	12.7
15-17.....	8.2	6.7
18-34.....	20.9	21.2
35-64.....	31.3	31.0
Over 64.....	4.1	3.5

vey of those who stated that they had received some Sabin vaccine: "Did you receive your Sabin vaccine during the mass oral poliomyelitis vaccination program held in Berks County during 1963?" About 60.3 percent, or 1,650 persons, stated that they had participated in the program and received either one, two, or three types of the vaccine. Sixty-one persons received the Sabin vaccine in other than the Berks County program, mainly in the Army or through a union. Participation in the Sabin vaccination program among those surveyed compares favorably with the 60.2 percent participation determined by the 1963 registration. Table 3 shows participation according to the two methods by age distribution.

Although the participation rates as determined by the two methods are comparable, the degree of complete-series protection differs between the two methods (table 4). The survey method showed that 58.3 percent of the residents of Berks County completed the series, and the registration method showed that 48.7 percent of the residents obtained the three types of vaccine. The percentage of persons receiving partial immunization (one or two types) was 4.2 percent by the survey compared with 11.5 percent by registration. The proportion of population obtaining no Sabin vaccine was estimated at 37.5 percent by the survey and 39.8 percent by registration.

The experiences of persons immunized with the Salk vaccine and some Sabin vaccine are compared in table 5. By the survey method, we determined that 34.4 percent of these persons

Table 4. Percent protection by Sabin vaccine, by selected age groups, as determined by 1964 survey and 1963 registration, Berks County, Pa.

Age group (years)	1964 survey			1963 registration		
	No vaccine	1 or 2 types	3 types	No vaccine	1 or 2 types	3 types
All ages.....	37.5	4.2	58.3	39.8	11.5	48.7
Under 6.....	37.0	7.9	55.1	25.2	17.9	56.9
6-9.....	11.8	1.5	86.7	5.5	7.5	87.0
10-14.....	4.4	3.5	92.1	9.1	5.3	85.6
15-17.....	11.7	4.3	84.0	4.9	10.2	84.9
18-34.....	28.1	5.1	66.7	37.5	16.3	46.2
35-64.....	46.1	3.9	50.0	52.0	10.2	37.8
Over 64.....	79.0	2.1	18.9	81.6	6.1	12.3

received three or more injections of the Salk vaccine and some Sabin vaccine, as compared with 29.6 percent by the registration method. From the survey, the experience of the population immunized by three or more doses of the Salk vaccine alone was estimated at 39.3 percent (table 6). No comparable figure was obtained by registration.

From the survey data, it was possible to estimate a total protection percentage for the county. Total protection means a complete series of injections with the Salk vaccine or a complete series of the Sabin vaccine or both. The total complete protection for the county on the basis of the survey was 64.8 percent. Table 6 indicates that many persons with previous Salk vaccine protection were re-immunized with the Sabin vaccine. The level of protection in all groups was increased by the Sabin program, especially in the school age children.

Table 5. Percent of population receiving 3 or more injections of Salk vaccine and some Sabin vaccine, by selected age groups, Berks County, Pa.

Age group (years)	1964 survey	1963 registration
All ages.....	34.4	29.6
Under 6.....	45.6	47.7
6-9.....	71.6	74.6
10-14.....	76.9	73.8
15-17.....	76.1	76.2
18-34.....	38.2	31.1
35-64.....	15.0	7.7
Over 64.....	2.5	2.6

With the registration method, using certain basic assumptions from the Salk vaccine experience of those not participating in the program, a total protection percentage of 65.3 was obtained (2). By either method, approximately two-thirds of the population was found to be well immunized.

Time and Cost of Methods

The survey required approximately 720 man-hours at an estimated cost of \$2,570 (table 7). All the work was done by employees of the Pennsylvania Department of Health, with the assistance of three volunteers. There were no additional expenditures for personnel and no direct costs for supplies and equipment.

The registration method required about 15,650 man-hours at an estimated cost of \$11,300. This included registration during

Table 6. Percent of population receiving complete series protection in 1963 by Salk or Sabin vaccine, or both, by selected age groups, as determined by 1964 survey, Berks County, Pa.

Age group (years)	Salk vaccine	Sabin vaccine	Total
All ages.....	39.3	58.3	64.8
Under 6.....	56.6	55.1	69.6
6-9.....	75.0	86.7	91.6
10-14.....	78.6	92.1	96.5
15-17.....	81.6	84.0	92.6
18-34.....	47.0	66.7	78.0
35-64.....	17.9	50.0	53.6
Over 64.....	4.0	18.9	20.5

Table 7. Comparison of estimated time and cost of 1964 survey and 1963 registration, Berks County, Pa.

	1964 survey		1963 registration	
	Man-hours	Cost	Man-hours	Cost
Total.....	720	\$2, 570	15, 650	\$11, 300
Design and preparation:				
Design and selection of sample.....	115	535	0	0
Instruction to interviewers and registrars.....	10	40	50	100
Design of questionnaires and forms.....	25	100	20	100
Printing of questionnaires and forms.....	5	25	0	1, 000
Field data collection:				
Interviews.....	400	1, 000	0	0
Clinic registration.....	0	0	5, 000	⁽¹⁾
Coding and data handling.....	75	300	10, 000	² 5, 500
Supplies and equipment.....	0	0	0	200
Tabulation and analysis:				
Tabulation.....	50	250	500	3, 760
Analysis.....	40	320	80	640

¹ Volunteer service at no cost.

² Does not include value of no-cost volunteer service.

clinic sessions by about 200 volunteers and 6,700 hours of 30 volunteers for handling postclinic data. Direct costs were \$1,000 for printing about 800,000 record forms, \$200 for supplies including 150 file boxes, and \$5,500 for salaries of the three additional clerks.

Comments

A registration method, in theory, should provide complete enumeration of the events or characteristics being studied. It is useful when accuracy is the major consideration. In a mass immunization program, where protection of the population is the primary objective and the study is secondary, errors will occur. These mainly will be in under-registering and collecting information from the recipients as they pass through long and hurried lines. An exacting registration procedure for a mass program would be difficult to set up, and the postclinic data handling is time consuming, arduous, and expensive. Any survey method has a sample variance inversely proportional to the sample size if the sample is small and recollection of the event diminishes with time before the interview. However, the results are entirely usable to gauge the effectiveness of a vaccination program and to indicate any additional vaccination needed.

As described in this study, the survey findings were comparable with those obtained by a registration method. A sample survey can be accomplished, with small expenditure of time and money, by regular employees with little training and orientation. A survey before and after a mass immunization program can be used by health departments to assess the need for vaccination and the effectiveness of programs.

Summary

The effectiveness of the oral poliomyelitis vaccination program from January to June 1963, in Berks County, Pa., was studied by registration of 171,256 participants. One year later, this registration was evaluated by a sample survey of 2,736 persons in 829 households. The findings from using these two methods were comparable.

By the survey method, we determined that 37.5 percent of the county population received no Sabin vaccine, 4.2 percent received one or two types, and 58.3 percent received all three types. By registration, the count showed that 39.8 percent of the county population received no Sabin vaccine, 11.5 percent received one or two types, and 48.7 percent of the total received all three types.

The survey required 720 man-hours and cost

\$2,570. Registration required 15,650 man-hours and cost \$11,300. Because of the ease of conducting a survey at much less time and cost, this is the preferred method for determining the community immunization level before or after a vaccination program.

REFERENCES

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Research by Local Health Departments

Of 1,731 local health departments receiving questionnaires about their research, most of the 1,053 replying reported they were doing none but believed they should be. Whether research was being conducted appeared to depend mainly on whether funds for it had been budgeted and whether the attitude of the health officer was favorable toward it.

The questionnaire was part of a study conducted by the American Public Health Association under a contract issued by the Division of Community Health Services, Bureau of State Services, Public Health Service, and a grant from the United Health Foundations, Inc.

The research committee of the APHA's health officers section voiced these conclusions after studying a preliminary report of the findings:

"The committee feels that research by local health departments is desirable but does not feel that every local health department should do research. There has been a tendency to encourage the belief that research should be an ongoing activity of every local health department. We do not agree. Effective research depends on capable researchers and facilities.

"Those departments wishing to do research and able, or potentially able, to do so should be supported to the fullest possible extent by both national and State official and voluntary agencies.

"The potential of many smaller health departments is not being fully exploited and should receive more attention.

"The encouragement and support of research is being largely given to the larger local health departments. Many small health departments have the potential to develop and carry out research projects. They should receive greater encouragement and support. More attention should be paid to the younger officer who will be the major researcher of tomorrow.

"It is the responsibility of the Department of Health, Education, and Welfare and of State health, education, and welfare departments to stimulate the development of research.

"We feel that all divisions of the Department of Health, Education, and Welfare, rather than solely the Public Health Service and State agency counterparts, have a stake in research by local health departments and should encourage and assist such activities.

"Federal and State agencies should encourage and support research by local health departments by financing seminars on research methodology, by research training grants to local departments, and by small grants designed to give new, potential research investigators actual supervised experience in developing protocols and carrying out research.

"In addition to supporting research itself, support is also needed to develop new research investigators. This is most needed in smaller departments. The development and maintenance of a national research potential is as important as is the conduct of current research activities.

"The U.S. Public Health Service should have a liaison member serving with the Health Officers Section Research Committee.

"The research committee has a valuable function and should continue. We feel that close cooperation between this committee and the Public Health Service is essential to assure the committee's maximum potential. This can be best effected by a Public Health Service liaison member serving with the committee.

"The Public Health Service should investigate in depth some of the questions raised by the data contained in this study.

"Our study was an initial effort to obtain an organized collection of data on the subject. Questions posed by this study deserve further investigation. We would like to see the Public Health Service, with its greater resources, carry this investigation further. The committee has shown that many local departments are either carrying out research or are interested and potentially capable. This finding warrants further study of the subject by the Public Health Service."