

# Measuring the Extent of Immunization

— in Grand Rapids and Kent County, Michigan —

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In 1950, a study to determine the extent of immunization procedures and of prenatal and postnatal services was made in Grand Rapids, Mich., a city of less than 200,000 population, where unusual emphasis has been placed upon immunization procedures for many years. Questionnaires were mailed to mothers of all babies aged 12 and 13 months, with follow-up by telephone or nurse's visit when replies were not received by mail. This method of sampling, which was similar to that used in a study in Philadelphia in 1949, and described by Kandle and Goetz (1, 2), appeared to be reliable and useful, especially with regard to patterns of practice, and had the added advantage of being simple and inexpensive. We hope that, in addition to the actual information obtained, further experience with the method, this time in a smaller community, will aid in evaluating its general usefulness as a public health tool.

The area for study was extended to include not only the city of Grand Rapids but also the surrounding territory comprising Kent County,

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in which about half the population is rural. The survey was conducted under the auspices of the city and county health departments. The pertussis field study group at the western Michigan section laboratory of the Michigan Department of Health, consisting of a nurse and a clerk, supervised by the laboratory section chief, and an additional nurse half-time for 4 months, formed the central working group for the study.

## Selection of Sample

The total population of the study area was estimated at 286,235, with 176,235 in Grand Rapids and 110,000 in Kent County outside the city, subsequently referred to in this report as city and county, respectively. The sample for study included all the babies born during January, February, and March 1949.

Separate card files were prepared for city and county, and the names of the baby and mother, the address, race, and date of birth, obtained from the official birth records, were recorded for each baby born during the 3 months selected. The files were checked against the death records to remove from the sample the names of babies that had died. One hundred and ninety-two illegitimate babies were also excluded. The files used in the study contained 1,728 names, 1,071 for the city and 657 for the county, comprising 24 percent of the total births for the year. At the time the questionnaires were mailed, mid-February 1950, the infants studied were from 11 to 13 months old.

The questionnaire was essentially like the one used in the Philadelphia study (2).

**Table 1. Number and percent of replies received before and after telephone follow-up and nurses' visits**

Questionnaires	Total		Grand Rapids		Kent County	
	Number	Percent	Number	percent	Number	Percent
Mailed.....	1,728	100.0	1,071	100.0	657	100.0
Answered.....	1,547	89.5	964	90.0	583	88.7
By mail, no follow-up.....	1,026	59.3	634	59.2	392	59.6
After telephone call.....	340	19.7	181	16.9	159	24.2
By nurse's visit.....	181	10.5	149	13.9	32	4.9
Not answered.....	181	10.5	107	10.0	74	11.3

**Preparation of the Community**

Following the procedure used in the Philadelphia study, the importance of community-wide cooperation was stressed, not only to assure the success of the project, but also to broaden the area of its educational effect. The fact that in Grand Rapids there was a background of 25 years of cooperative work by the Michigan Department of Health Laboratory and the local health departments, including a series of field studies, facilitated the project. In the weeks just preceding mailing of the questionnaires every effort was made to acquaint the public with the survey objectives. The plan was outlined to the physicians through the Kent County Medical Society and the local Pediatrics Society. Through the health chairman of the Parent-Teachers Association, announcements were made to their local groups. In mid-February the two daily newspapers in the city and the weekly papers in the county carried news stories and a few weeks later followed up with feature stories. The local radio

stations made spot announcements during the week the questionnaires were sent out.

**Returns**

Three weeks after mailing the questionnaires, telephone follow-up was started. The two study nurses and the clerk reached as many as possible of the mothers from whom replies had not been received. In those instances in which the original form was reported lost or not received, a second questionnaire was sent. Three weeks later the nurses began home visits in the city. The two study nurses, with the help of the bureau of public health nurses, made the calls within the city. The county calls were left until last because of road conditions, and were made entirely by the two study nurses.

The number and percent of replies are summarized in table 1.

Of the 1,728 questionnaires sent by mail, 1,071 were to mothers living in the city of Grand Rapids and 657 were to residents of Kent County. The 1,026 replies received by mail

**Table 2. Summary of replies to questions concerning immunization against pertussis**

Immunization	Total area		Grand Rapids		Kent County	
	Number	Percent	Number	Percent	Number	Percent
Yes.....	1,228	<sup>1</sup> 79.4 ± 3.1	805	<sup>1</sup> 83.6 ± 3.6	423	<sup>1</sup> 72.5 ± 5.6
By own doctor.....	960	78.2	578	71.8	382	90.3
By health department clinic.....	245	19.9	209	26.0	36	8.5
Not stated.....	23	1.9	18	2.2	5	1.2
No.....	309	20.0	154	15.9	155	26.6
Not stated.....	10	.6	5	.5	5	.9

<sup>1</sup> Three times  $\sigma$  percent (assuming simple randomness).

without follow-up comprised 59.3 percent of the total, with the city and county returns in almost the same proportion. Telephone follow-up increased the replies to 79 percent, and nurses' visits brought in 10.5 percent more, making the final percentage 89.5. The proportions of replies received for Grand Rapids and for Kent County were essentially the same, 90 percent compared with 88.7. The relatively greater effectiveness of the telephone follow-up in the county is explained by the fact that greater effort was made to reach rural residents by telephone in order to save the time and expense of a nurse's visit. Replies were not obtained from 181 mothers (10.5 percent of the sample). The families could not be located, and it was presumed that they had moved or that the original address had been in error. The replies totaled 1,547, or 21 percent of the births during 1949, whereas in the Philadelphia survey, 61 percent of the questionnaires were returned by mail without follow-up and the total replies comprised 84 percent of the sample, which in turn represented 12.6 percent of the births for the year.

#### Analysis of Replies

The replies to the questionnaires were tabulated separately for the city of Grand Rapids and for the surrounding Kent County area. Within the city the four geographic divisions—northeast, northwest, southeast, and southwest—were analyzed separately, but the observed differences were so small that only the combined data are presented here.

The sample was composed entirely of white persons except for 45 Negroes in the city and 2

Indians, 1 in the city and 1 in the county. Thirty-five of the questionnaires concerning Negro infants were returned. While the sample was small, the replies suggested that in comparison with the white babies fewer of the Negro babies had been immunized, and that a larger percentage of the Negro babies had been taken to public clinics.

#### *Pertussis Immunization*

The replies to the question concerning pertussis immunization are summarized in table 2. The percentages are based upon the number of questionnaires that were answered.

The replies indicate that 83.6 percent of the Grand Rapids babies had received one or more immunizing injections against pertussis, while in the county the percentage was 72.5. Private physicians gave 71.8 percent of the inoculations in the city and 90.3 percent in the county. The results of the corollary question concerning the number of doses are summarized in table 3.

According to the table, 55.2 percent of the Grand Rapids babies and 48.5 percent of those in the county had at least two doses of pertussis vaccine. For the entire area the percentage was 52.7. Nine and eight-tenths percent were stated to have had one dose, and for 16.9 percent the number of doses was not stated.

Subsequent to the tabulation and analysis of the data from the questionnaires, further information was obtained concerning the pertussis immunization status of the babies in the Grand Rapids sample. Since the results of the second follow-up have significance with respect to both major objectives of the study, namely, actual information and evaluation of the method, the additional data are included here.

**Table 3. Summary of replies related to number of doses of pertussis vaccine**

Was the baby immunized?	How many doses?	Total area		Grand Rapids		Kent County	
		Number	Percent	Number	Percent	Number	Percent
Yes	1	152	9.8	107	11.1	45	7.7
	2 or more	815	52.7	532	55.2	283	48.5
	Not stated	261	16.9	166	17.1	95	16.3
No		309	20.0	154	15.9	155	26.6
Not stated		10	.6	5	.5	5	.9

We were concerned first by the large number of replies in which the number of doses was not stated, although the main question, "Has the baby been immunized . . .?" was answered affirmatively. Of the 166 who gave such replies in Grand Rapids, we were able to investigate 124 further: 38 were found in the city health department immunization clinic files and 86 who had been immunized by private physicians were checked by telephone call to mother or doctor. All of these 124 babies had a record of two or more injections of combined diphtheria toxoid and pertussis vaccine at the time of the survey.

We were also interested in the babies stated to have had one dose of pertussis vaccine. According to the questionnaires, many of these had received smallpox vaccination, usually not given until diphtheria and pertussis injections are completed. Of the 107 Grand Rapids babies in this category (table 3), 79 were located again. Twenty-one were found in the city immunization file and of these, 13 had completed the series at the time of the survey. Of those immunized by their own doctor, 58 were found again. Seventeen had had only one injection, 2 had received two injections, and 39, the full course of inoculations at the time of the survey. Referring now to table 3, if we add to the 532 with "two or more" doses of vaccine the 124 from the "not stated" group and the 54 from the "one dose" group we have 710 with at least two doses, or 74 percent of the Grand Rapids sample. This is obviously still less than the true figure since 72 of the "not stated" and "one dose" groups were not followed up the second time. Why so many mothers either left unanswered the question on

number of doses, or gave the incorrect answer of "one dose" when the child had actually had the complete course we do not know. A different wording of the questionnaire, such as "How many injections?" might have been more successful.

#### *Diphtheria Immunization*

The replies to the second question, which concerned diphtheria immunization, are summarized in table 4.

Since combined diphtheria toxoid and pertussis vaccine had been in general use in this area for several years, similar replies would be expected to the first two questions, and the differences observed in the figures in tables 2 and 4 are small. For the whole area, 75.8 percent of the babies were stated to have received diphtheria immunization. The Philadelphia survey indicated that in that city 63 percent of the white babies and 41 percent of the Negro babies had two or more immunizing injections against diphtheria.

#### *Smallpox Vaccination*

The replies to the question on smallpox vaccination indicated a relatively low level of immunization at the age sampled—27 percent in the county and 40 percent in Grand Rapids, or 35 percent in the entire area. This is explained by the fact that the recommended procedure here advises smallpox vaccination at 1 year of age.

#### *Prenatal Care*

The replies to the questions regarding prenatal care indicated almost identical patterns in the city and the more rural area within the

**Table 4. Summary of replies to questions concerning diphtheria immunization**

Immunization	Total area		Grand Rapids		Kent County	
	Number	Percent	Number	Percent	Number	Percent
Yes.....	1, 172	75. 8±3. 7	769	79. 7±4. 4	403	69. 1±7. 0
By own doctor.....	939	80. 1	572	74. 4	367	91. 0
By health department.....	222	19. 0	190	24. 7	32	8. 0
Not stated.....	11	. 9	7	. 9	4	1. 0
No.....	350	22. 6	179	18. 6	171	29. 3
Not stated.....	25	1. 6	16	1. 7	9	1. 6

<sup>1</sup> Three times  $\sigma$  percent.

**Table 5. Analysis of replies to question concerning pertussis immunization from the Grand Rapids area, according to those obtained by mail, telephone call, and nurse's visit**

Replies	Total	Yes		No		Not stated	
		Number	Percent	Number	Percent	Number	Percent
Total.....	964	805	83.5 ± 3.6	154	16.0	5	0.5
By mail.....	634	570	89.9	62	9.8	2	.3
By telephone.....	181	131	72.4	47	26.0	3	1.7
By nurse's visit.....	149	104	69.8	45	30.2	0	.0

<sup>1</sup> Three times  $\sigma$  percent.

county. In answer to the query, "Who took care of you during your pregnancy?" 98 percent of the mothers stated "private physician," 1 percent (18 mothers) stated "hospital clinic," and 1 percent left the question unanswered. As to the time of first visit to doctor or clinic, 78 percent went during the first trimester, 18 percent during the second, 2 percent in the last trimester, and 2 percent did not state time of visit. With regard to nursing care, 15 percent of the Kent County mothers and 18 percent of the Grand Rapids mothers stated they had been visited by a public health nurse during their pregnancy. About one-fourth of those receiving visits had only one, while 50 percent had received from two to four visits.

#### *Postnatal Care*

The replies to the questions regarding postnatal care revealed several differences between the two areas under study. Eighty percent of the Grand Rapids mothers said they had been visited by a nurse after the birth of their baby, compared with 47 percent of the Kent County mothers. In this connection it should be explained that the community health nurses make visits only within the metropolitan area of Grand Rapids.

At least 85 percent of those receiving nurse's visits stated that the nurse called during the first month after the baby's birth; 34 percent recorded only one visit, and 55 percent stated there had been from two to four.

Eight percent of the mothers in both areas stated that their babies had received no medical check-up. An additional 4 percent left this question unanswered. Among those who had medical attention, the number of check-ups

varied, with more for city than county babies. Approximately 50 percent had from one to four, while roughly one-fourth had from five to nine. Medical check-ups for 84 percent of the Grand Rapids babies were made by private physicians, 1 percent by a hospital, and 13 percent by the baby clinic. In the county, 92 percent were made by a private doctor, 2 percent by a hospital, and 4 percent by the baby clinic.

#### *Comments by Mothers*

A postscript to the questionnaire, asking for suggestions for the improvement of child-care services, brought responses from 124 mothers, half in the city and half in the county. About one-third of the statements expressed only gratitude and commendation. There were 23 definite complaints, most of them because of "lack of nursing service." Twenty mothers requested help on specific problems, such as need for transportation to an immunization clinic or advice concerning a sick baby. Of 20 constructive suggestions from city mothers and 29 from mothers in the county, 16 asked for more nursing service, 13 cited the need for making known the available services, and 20 requested more immunization clinics and well-baby clinics.

#### **Comparative Value of Follow-Up**

The question arises as to the value of the follow-up by telephone and nurse's visit to obtain replies not returned directly by mail. For information as to whether it was worth the additional time, effort, and money required to gather the telephone and visit data, the replies to the question on pertussis immunization for

the Grand Rapids sample were analyzed with respect to the method by which they were obtained. Table 5 shows the breakdown of the 964 replies to the questionnaires sent to 1,071 mothers.

The percentages of affirmative replies by mail, telephone, and nurse's visit were 89.9, 72.4, and 69.8, respectively, indicating a statistically significant difference. These results suggest that the data concerning the 107 babies for whom questionnaires were not returned would also have been different from the data returned directly by mail and emphasize the limitations of the survey method.

### Summary and Conclusions

1. A survey of the immunization status of 1-year-old infants and of certain nursing services to mothers and babies was conducted in Grand Rapids and Kent County, Mich. The sample was selected and data obtained according to the method of Kandle and Goetz, using a mailed questionnaire with follow-up by telephone calls and nurses' visits.

2. Replies were received from 89.5 percent of the mothers to whom questionnaires were sent. The sample of 1,547 replies represented 21.5 percent of the births during 1949.

3. According to the replies, two or more injections of pertussis vaccine had been given to 52.7 percent of the infants. As a validation procedure, this information was amplified and corrected by checking with the city health department immunization files and by additional follow-up by telephone. The corrected figure for the city was about 74 percent. The survey method was considered inadequate for obtaining such detailed information as number of injections.

4. In Grand Rapids, 71.8 percent of the babies who had been immunized received their pertussis immunization from private physicians and 26 percent from the health department clinic; in the county these percentages were 90.3 and 8.5, respectively.

5. Prenatal care was given almost entirely by private physician rather than hospital clinic or health department. Fifteen percent of the mothers in the county and 18 percent in the city had been visited by a public health nurse during their pregnancy.

6. The pattern of postnatal care varied somewhat in the two areas; more nursing calls were made in the city than in the county, and a higher percentage of the city babies were taken to baby clinics for medical check-ups.

7. The comments by the mothers showed a surprising lack of knowledge of the health services available in the community. As the study progressed there was obviously an increased interest which, although not subject to measurement, indicated that the survey had educational value.

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### REFERENCES

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