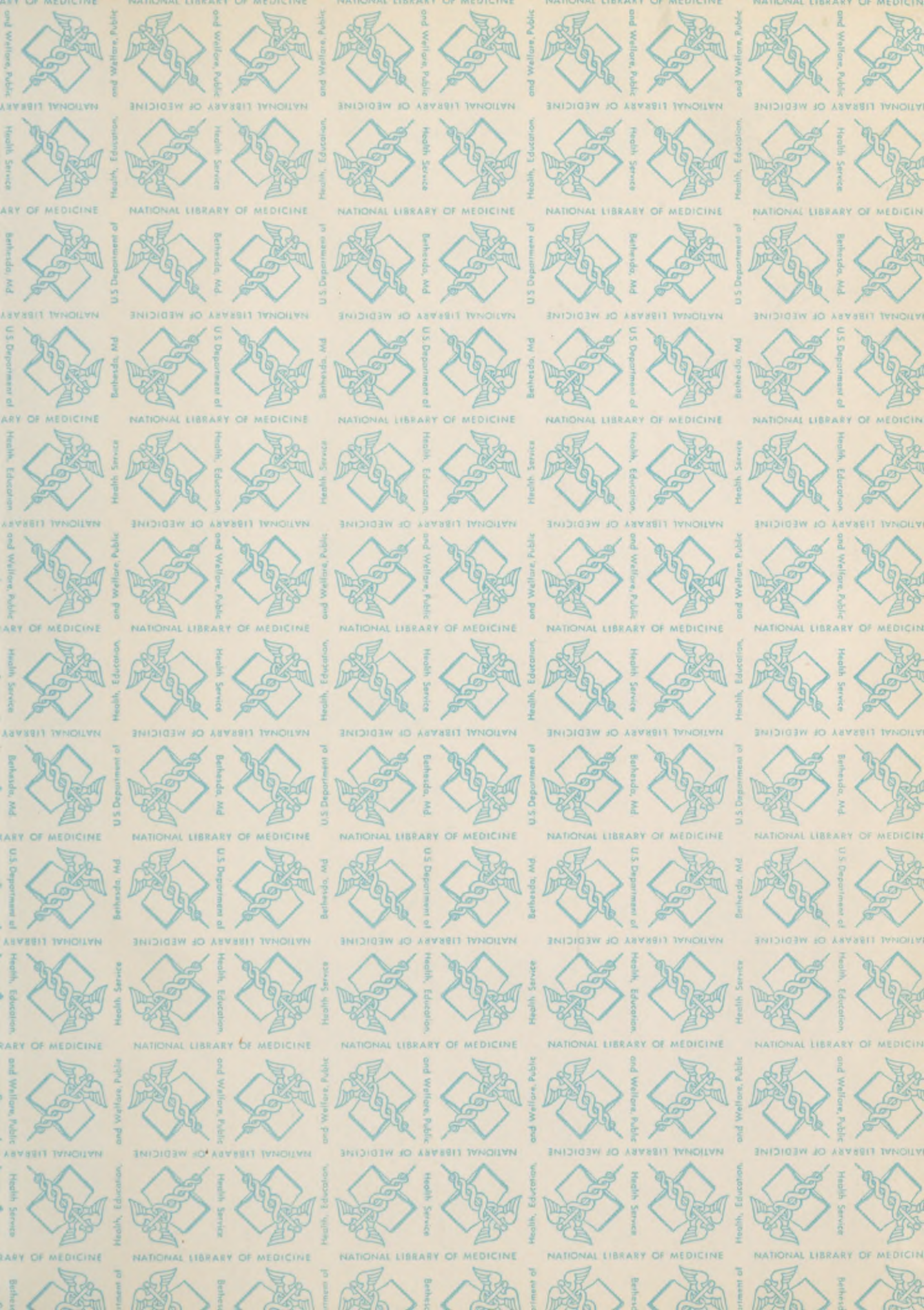
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San Francisco Hearing and Speech Center

RUBELLA AND DEAF CHILDREN
IN CALIFORNIA

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San Francisco Hearing and Speech Center

2340 Clay Street

San Francisco, California 94115

August 1, 1967

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Rubella (German Measles), although usually a mild disease for an adult or child, can have a devastating effect on an unborn child when a mother contracts the disease during the first months of pregnancy. Those who work with hearing-impaired children are familiar with the history of maternal rubella during the first trimester of pregnancy. Many of these children also have other significant physical defects. When there is an increased outbreak or epidemic of rubella in the general population, with a resultant increase in the number of children born with sensory handicaps, it is important for those concerned with special education to be aware of the extent of the increased incidence and prepare for an increased number of children with special learning problems.

Nature of Rubella:

Rubella is a viral disease common throughout the world. Its highest incidence occurs in late winter and early spring. It is spread by naso-pharyngeal secretions of infected persons through direct contact with the patient, indirect contact with his soiled articles, or it may be transported by air-borne droplets. The incubation period is from 14 to 21 days. Since the disease may be very mild, symptoms of rash and a slight fever may be overlooked. The disease is communicable from one week before the onset of the rash to about 4 days after. Absolute diagnosis is made through blood or urine analyses, through collection of throat washings, or through autopsy tissues. Immunity can be ascertained by blood tests.

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other than exposure to an infected person in the hope that the disease will be contracted at a convenient time. One attack is thought to confer permanent immunity. Globulin treatment is short term and of doubtful effect. Vaccine is being developed but its use is believed to be a few years away. (California State Department of Public Health, A Manual for the Control of Communicable Diseases in California, 1966, p. 289)

A study of rubella babies in Houston (Baylor Rubella Study Group, "Rubella: Epidemic in Retrospect", Hospital Practice, II, #3, 1967) gives evidence of post-natal viral infection of the baby, presenting a hazard of contagion. There is a strong possibility that in some cases the damage to the baby will continue to increase even after birth.

Nature of Rubella Babies With Hearing Loss:

Fifty-five cases of hearing-impaired children, for whom maternal rubella during the first trimester was confirmed by the referring physician, were reviewed. These children were referred to the Center between July 1, 1965 and August 1, 1967. They were born between 1962 and 1966; some were deaf as a result of the 1964 outbreak, some from the 1965 epidemic, and some from earlier rubella incidence.

All children had significant hearing losses. Thirty-eight had losses that would be considered profound with no responses to tones above 500 cps or 1000 cps. Thirteen had hearing through 4000 cps but at levels of 80 to 90 dB. Four children had a fairly flat, moderate loss.

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Table 1. Incidence of Other Physical Disorders and Diseases Among 55 Post-Rubella Babies with Significant Hearing Loss

	Number	Percentage of Total
Number with Other Significant Physical Disorders (heart, vision, slow motor, hyperactive)	22	40%
Number with Eye Impairment Only	6	11%
Number with Heart Impairment Only	6	11%
Number with Both Eye and Heart Impairment	8	14%
Number with Neuro-Motor Function Disorders Only (slow motor, hyperactivity)	2	4%
Number with History of Ear Infection	26	47%

Twenty-two (40%) had some significant physical disorder. Fourteen had eye impairment; fourteen had heart impairment. Eight had eye, heart, and hearing impairment combined.

Highly surprising was the incidence of ear infections among these children; nearly half of the group had some history of ear infection. Since the severe sensori-neural hearing loss is such an overriding disorder, ear infections may be overlooked in some case histories because of seeming unimportance. It has been assumed that the damage to the hearing mechanism from rubella is in the cochlea or eighth nerve. It may also be possible that abnormal development of the middle ear or naso-pharynx may leave these children more susceptible to ear infections, much as cleft-palate children are. It may also be that they are generally weaker, have lower resistance to all infection, and thus have more ear infections. The nature of these ear infections bears investigation along with the adequacy of the middle ear and naso-pharyngeal structures.

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Incidence of Rubella:

A major epidemic of rubella occurred in the eastern part of the country in 1964. The Pacific Coast at that time experienced some rise in incidence which was not considered to have reached epidemic proportions. Reporting of the disease continued to be voluntary in California. However, at the San Francisco Hearing and Speech Center, and apparently at other facilities dealing with young hearing-handicapped children, there was a significant increase in the number of deaf babies referred for testing or special training in 1965. A few of these had rubella history, suspected or confirmed, but many (about 40%) were deaf from unknown causes. New referrals of babies affected by the 1964 rubella outbreak continued to come to the Center during 1966 and have continued during 1967. The results of this increased incidence of rubella of 1964, which was not considered to be a major disease outbreak, may have a major effect on programs for the education of deaf children in the West.

From past experience, it was predicted that the epidemic of rubella in the East in 1964 would be followed by an epidemic in the West in 1965. Oregon, where reporting was mandatory, recorded 7,912 cases in the first three months of 1965 against 862 cases in the same period of 1964. Washington state reported a four-fold increase over the number from the previous year. Early in 1965 it was apparent from reports of California Public Health Department offices taht a major epidemic was underway. In May, the Department of Public Health warned of the epidemic through its bulletin California's Health (Vol. 22, No. 22, p. 207). However, reporting of rubella incidence continued to be voluntary through 1965.

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Table 2. shows the incidence of cases of rubella in the general

population of California reported by public health departments during 1964, 1965, 1966, and during the first eight months of 1967. It is apparent from these data the incidence of reported cases in 1965 was over 5 times that of the outbreak recorded in 1964 which has already been partly responsible for an increased incidence of children born deaf.

Table 2. Number of Cases of Rubella Voluntarily Reported by County Health Departments in California during 1964, 1965, 1966, and eight months of 1967.

	1964	1965	1966	1967 *
January	26	445	197	290
February	40	860	291	805
March	117	1414	575	1628
April	283	2966	705	1577
May	413	2517	424	2725
June	591	1110	259	1599
July	19	104	32	247
August	22	25	20	117
September	10	18	44	
October	59	63	62	
November	60	73	82	
December	253	64	148*	
Totals	1893	9659	2839	8988

* After Mandatory Reporting Date.

It is also apparent that the incidence reported in 1966, though not nearly so large as in 1965, was of significance and was higher than reported in the outbreak of 1964. These data are reflected in Figure 1., showing graphically the incidence of rubella by month as reported by County Departments of Public Health. After the experience of three years of outbreaks of increased incidence, reporting of the disease became mandatory on November 20, 1966 (Section 2500, California Administrative Code, title 17, Public Health). Although the barn door was not yet closed, it was at least recognized that some horses might have been stolen.

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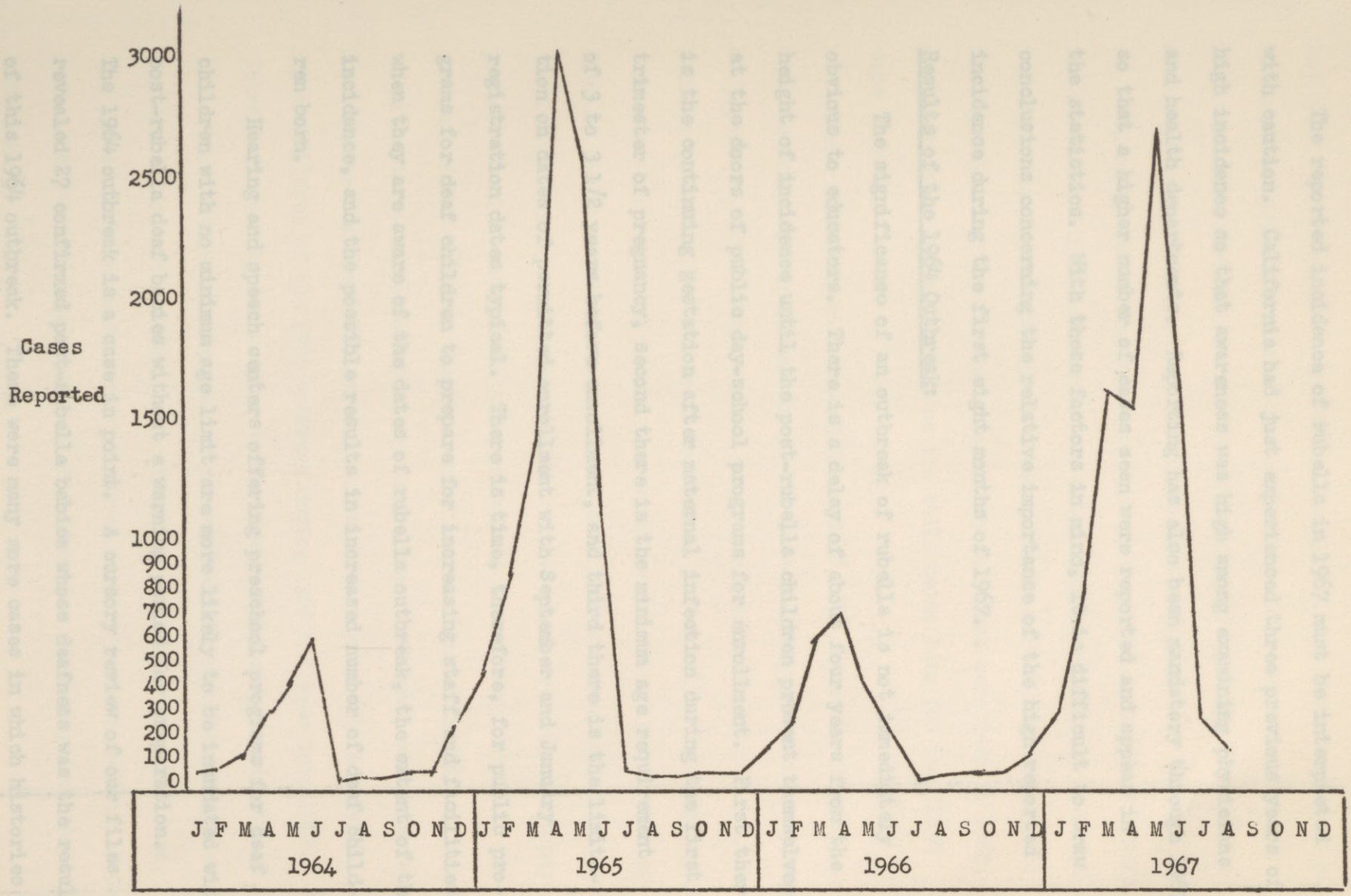
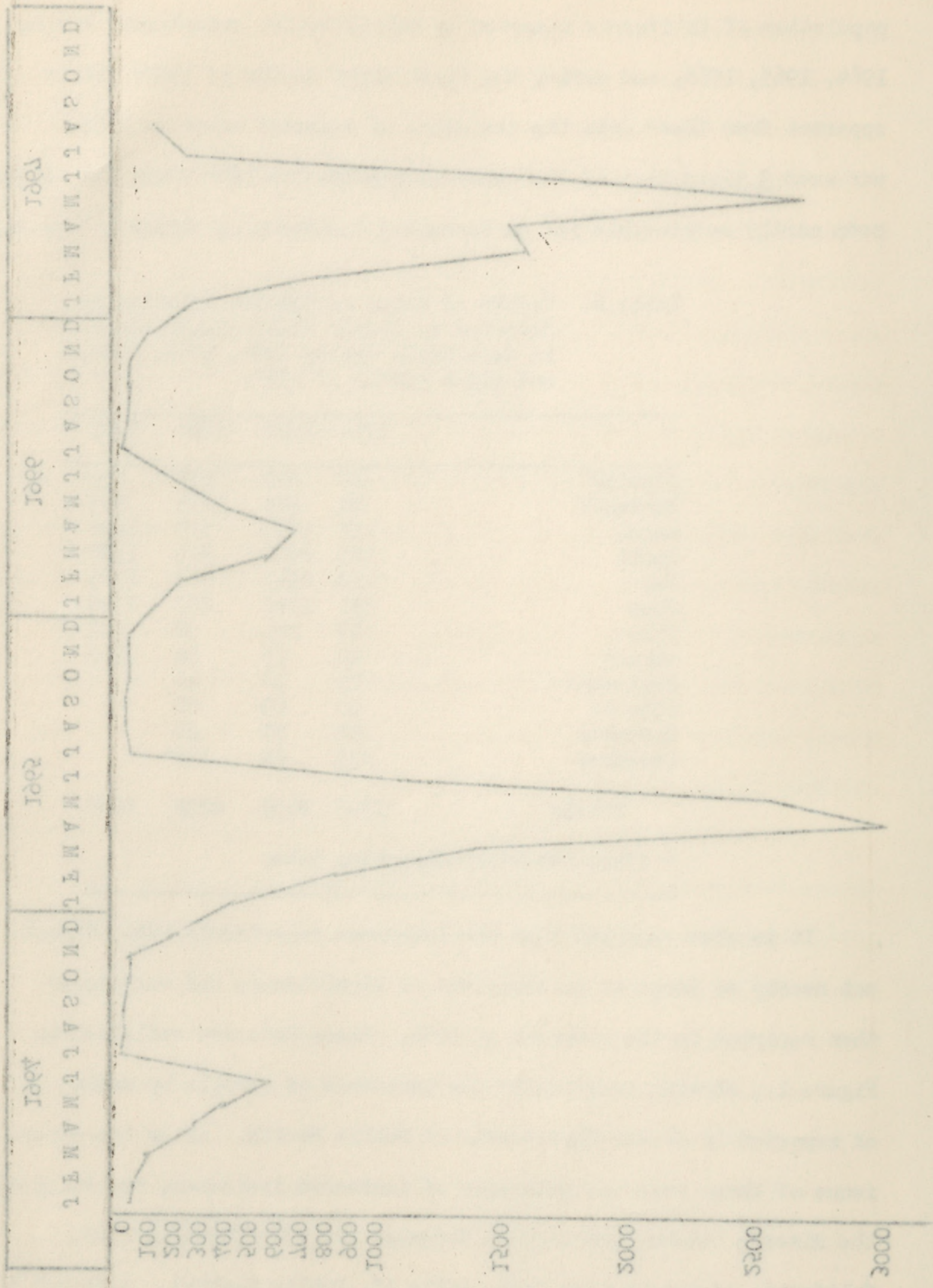


Figure 1. Incidence of Rubella in the General Population of California Reported by County Public Health Departments



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The reported incidence of rubella in 1967 must be interpreted with caution. California had just experienced three previous years of high incidence so that awareness was high among examining physicians and health departments. Reporting has also been mandatory through 1967 so that a higher number of cases seen were reported and appear in the statistics. With these factors in mind, it is difficult to draw conclusions concerning the relative importance of the high reported incidence during the first eight months of 1967.

Results of the 1964 Outbreak:

The significance of an outbreak of rubella is not immediately obvious to educators. There is a delay of about four years from the height of incidence until the post-rubella children present themselves at the doors of public day-school programs for enrollment. First there is the continuing gestation after maternal infection during the first trimester of pregnancy, second there is the minimum age requirement of 3 to 3 1/2 years before enrollment, and third there is the limitation on dates of permitted enrollment with September and January registration dates typical. There is time, therefore, for public programs for deaf children to prepare for increasing staff and facilities when they are aware of the dates of rubella outbreak, the extent of the incidence, and the possible results in increased number of deaf children born.

Hearing and speech centers offering preschool programs for deaf children with no minimum age limit are more likely to be inundated with post-rubella deaf babies without a warning period for preparation. The 1964 outbreak is a case in point. A cursory review of our files revealed 27 confirmed post-rubella babies whose deafness was the result of this 1964 outbreak. There were many more cases in which histories

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indicated the mother was exposed to rubella but the disease was not confirmed, in which the cause of deafness was unknown but the child was born at a time associated with the outbreak, and in which the child's disorders were those commonly associated with rubella.

Figure 2. shows time relationships of the 1964 outbreak of rubella, the birth month of 27 children born with significant hearing loss following the outbreak, and the month these children were first referred to the San Francisco Hearing and Speech Center. Some were seen in 1965, most were seen in 1966, and some are still being seen for the first time in 1967.

These children, born around the end of 1964 and early in 1965, will be ready for enrollment in public preschool day classes in January or September, 1968. Some will be ready for enrollment in residential schools in 1970. The number of confirmed, post-rubella, hearing-impaired babies we have reported in our review (27 cases) is not nearly indicative of the increase in the number of deaf babies throughout the state resulting from this outbreak of 1964. These cases are only the exposed part of the iceberg. There are problems in determining the total increase. First there is the problem of confirmation of a disease so mild as often to go unnoticed by the pregnant woman. Second, our experience with referral of deaf babies suggests that we may see still more of these children of the 1964 outbreak during 1967 and even into 1968. Third, we are only now keeping track of all children referred with a history of confirmed or suspected maternal rubella. And fourth, the San Francisco Center is only one of several centers in the Bay Area, and one of many in California. There is still a need to collect statistics of the state-wide incidence of deaf babies resulting from the 1964 outbreak.

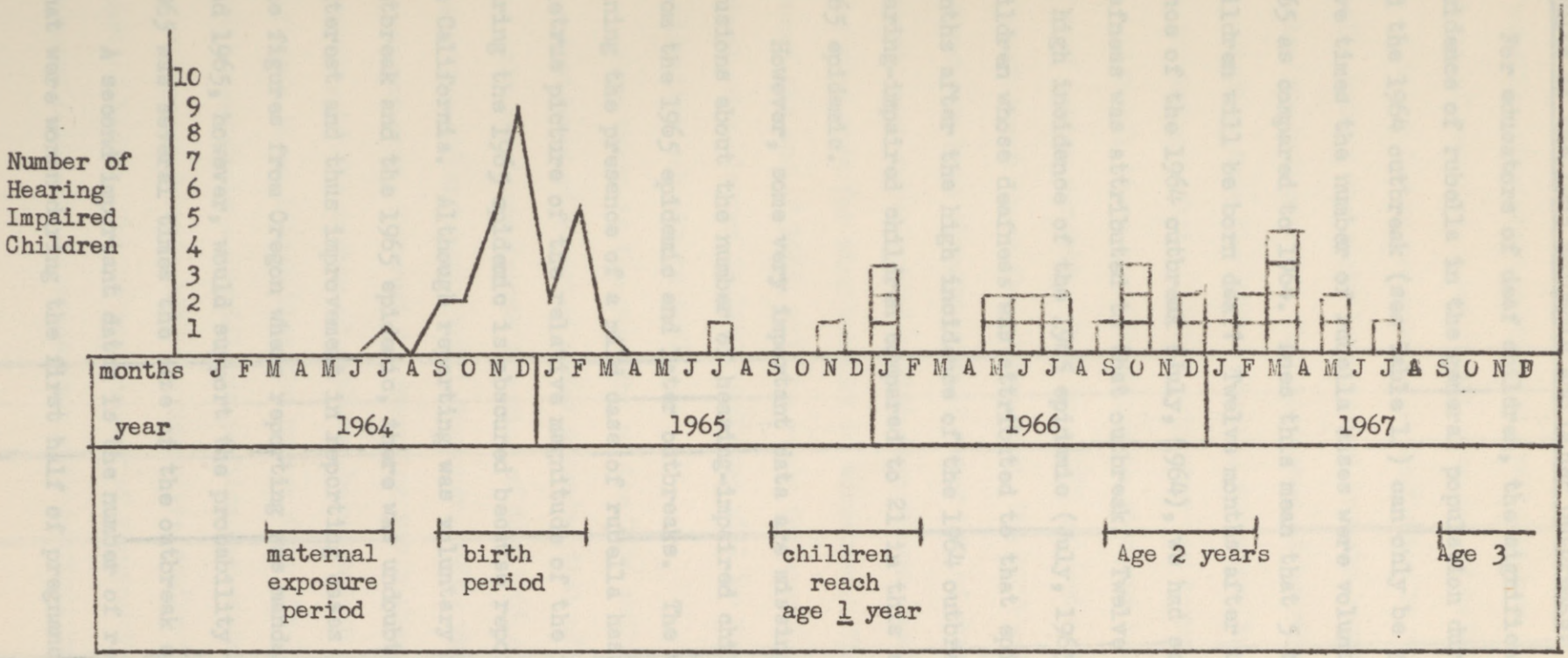

Figure 2. Birth months of 27 children born with hearing impairment as a result of the 1964 rubella outbreak who were referred to the San Francisco Hearing and Speech Center, and months of referral of these children to the Center.

Figure 2. Birth months of 27 children born with bilateral impairment as a result of the 1994 Rubella outbreak who were referred to the Ear Foundation Hearing Speech Centre, and months of referral of these children to the Speech Centre.

Results of the 1965 Epidemic and Other Outbreaks:

For educators of deaf children, the significance of the relative incidence of rubella in the general population during the 1965 epidemic and the 1964 outbreak (see Table 1.) can only be guessed. More than five times the number of rubella cases were voluntarily reported during 1965 as compared to 1964. Does this mean that 5 times the number of children will be born deaf? Twelve months after the end of high incidence of the 1964 outbreak (July, 1964), we had seen one child whose deafness was attributed to that outbreak. Twelve months after the end of high incidence of the 1965 epidemic (July, 1965), we had seen six children whose deafness was attributed to that epidemic. Twenty-four months after the high incidence of the 1964 outbreak we had seen 11 hearing-impaired children compared to 21 in this same time after the 1965 epidemic.

However, some very important data are missing for us to draw conclusions about the number of hearing-impaired children to be anticipated from the 1965 epidemic and later outbreaks. The difficulty of determining the presence of a mild case of rubella has already been mentioned. Thetrue picture of the relative magnitude of the incidence of rubella during the 1965 epidemic is obscured because reporting was not mandatory in California. Although reporting was voluntary for both the 1964 outbreak and the 1965 epidemic, there was undoubtedly some increased interest and thus improvement in reporting cases during the 1965 epidemic. The figures from Oregon where reporting was mandatory during both 1964 and 1965, however, would support the probability that the epidemic of 1965 was several times the size of the outbreak of 1964.

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mated that one-fifth of the women of child-bearing age are susceptible to rubella. Incidence statistics available now consist of raw total numbers of reported cases of all ages and of both sexes.

A third factor necessary for prediction is the number of post-rubella babies who might be expected to have hearing impairment. The Houston study suggests a high incidence of hearing loss in the population studies from the 1964 outbreak, somewhere in the nature of half of the surviving infants. Other estimates are lower.

With all these considerations in mind, we believe the incidence of deaf babies resulting from the 1965 epidemic will be in the nature of about three times the number from the 1964 outbreak. From the 1965 epidemic we have already seen 22 cases (as of August 1, 1967) of confirmed, post-rubella babies with significant hearing loss and have seen many more for whom rubella is suspected. These children, born around the end of 1965, will be ready for enrollment in public, pre-school, day classes in 1969, and some will be ready for enrollment in residential schools in 1971.

Then there is the question of the 1966 outbreak (see Table 2.). The incidence of reported cases exceeded that of the 1964 outbreak but was only about one-fourth the size of the 1965 epidemic. Mandatory reporting did not begin until November, 1966, when the bulk of that outbreak was over. Interest in reporting was higher for 1966 than in 1964. However, if the number of children born deaf as a result of the 1966 outbreak is no larger than the number from the 1964 outbreak, this will still constitute a significant problem for educational programs.

Figures for the 1967 incidence are coming in on a mandatory reporting basis. But we have no way of knowing the real extent of the present outbreak, in comparison with previous years.

Nature of the Educational Problem:

Two major educational problems are posed by the post-rubella babies -- first, a massive increase in the number of handicapped children, and second, an increased complexity of the educational task. The San Francisco Hearing and Speech Center's Preschool Program for Hearing Handicapped Children has already begun to experience the cumulative effect of successive outbreaks of rubella in California. Figure 3. shows the increase in the number of hearing-impaired children (from all causes) enrolled in our Preschool Program in relation to the dates of major outbreaks in 1964, 1965, 1966, and the reported incidence of 1967. Many of the children are confirmed post-rubella cases, many more are suspected but not confirmed, and some are from unknown causes. The program, which typically operated with an enrollment of from 12 to 15 children each year, closed the 1966-67 school year with 107 children enrolled in June.

Figure 2. shows time relationships of the 1964 outbreak, birth of hearing-impaired children, and the date of their referral to the Center for evaluation and help. Near the bottom of the figure there are bars showing the period of maternal exposure, the period of births, and the period when these children associated with the 1964 outbreak reached their first, second, and third birthdays. Figure 5. carries this time dimension several steps further, charting similar periods associated with the 1965 epidemic and the 1966 outbreak. If our predictions hold true, from these three exposure periods (1964, 1965, and 1966) there should be increased numbers of hearing-impaired children each year seeking private preschool and clinical help from 1965 into 1970, seeking enrollment in public day preschool classes from 1968 into 1972, and seeking enrollment in state-supported, resi-

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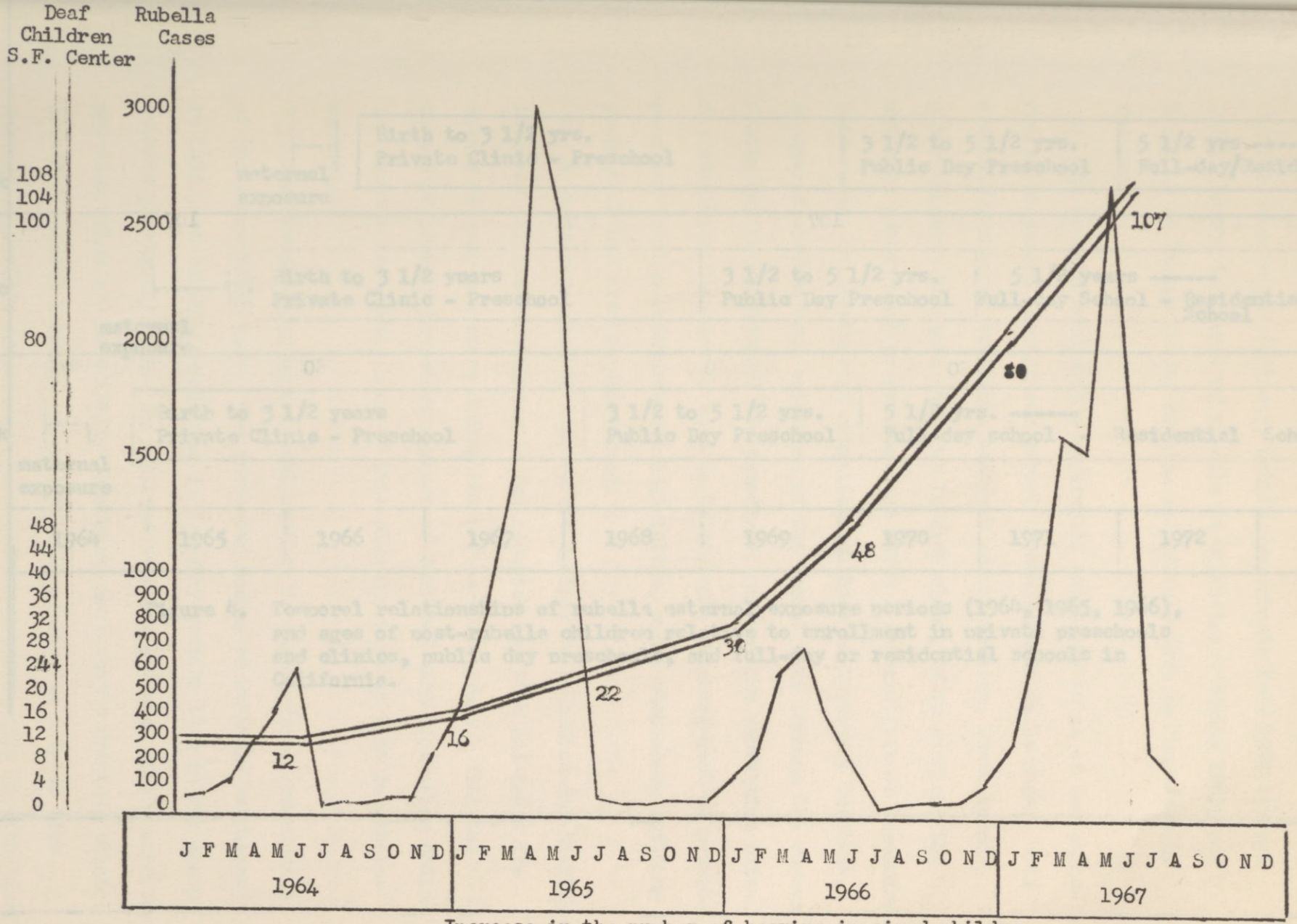
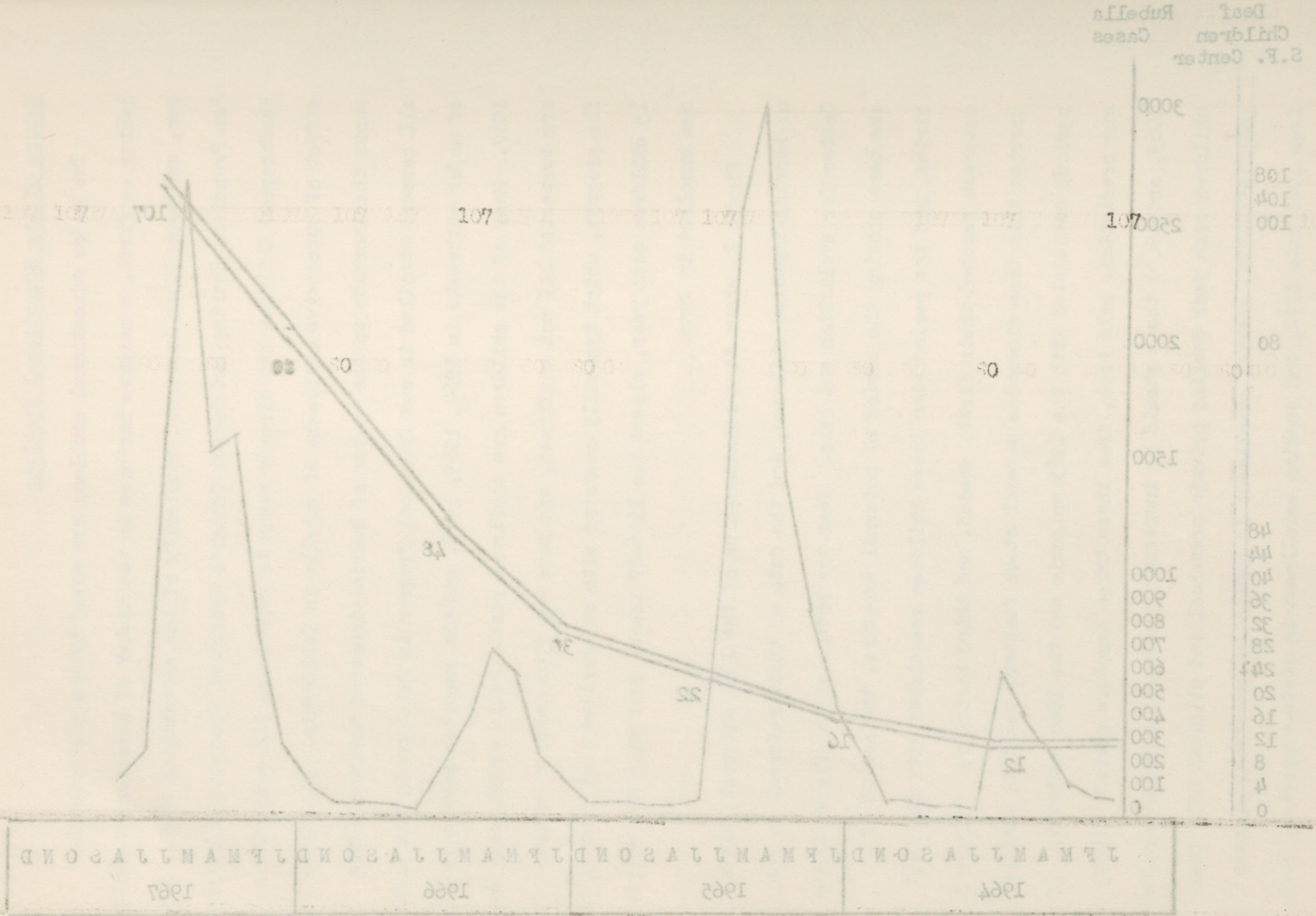


Figure 3. Increase in the number of hearing-impaired children (from all causes) enrolled in S.F. Center's Preschool Program in relation to the dates of major outbreaks of rubella in 1964, 1965, 1966 and repeated incidence in 1967



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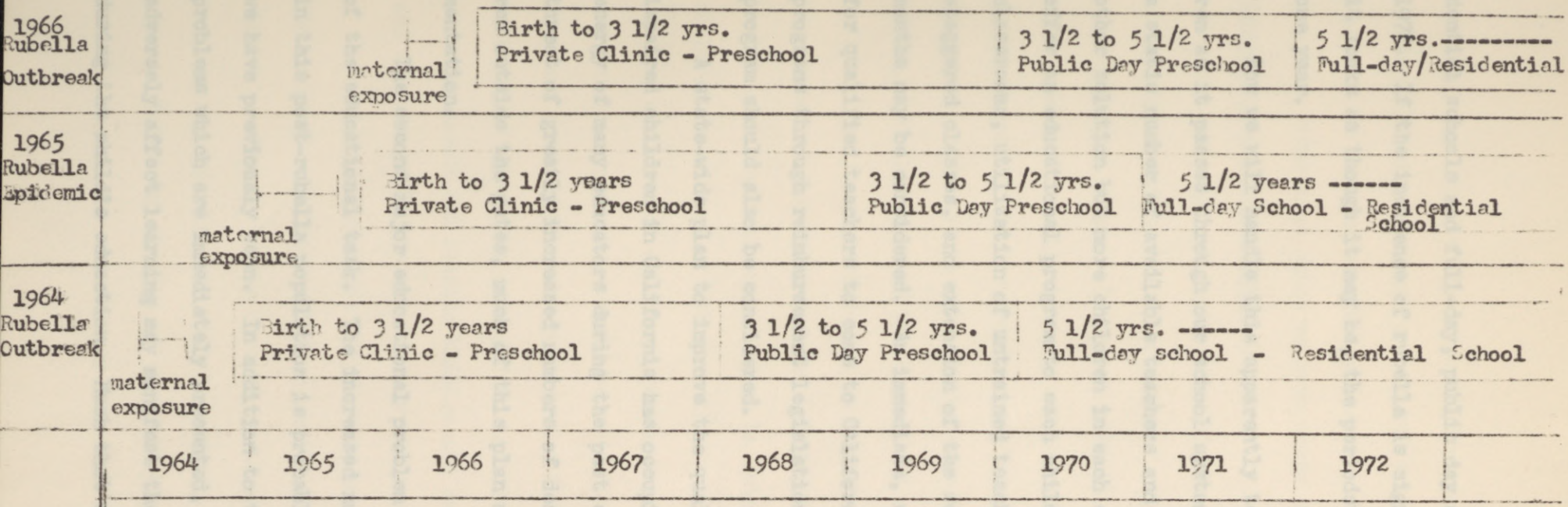

Figure 4. Temporal relationships of rubella maternal exposure periods (1964, 1965, 1966), and ages of post-rubella children relative to enrollment in private preschools and clinics, public day preschools, and full-day or residential schools in California.

dential schools and full-day, public day schools from 1970 through 1972. If the incidence of rubella is significant during 1967, and it looks as though it may be, the periods may each be increased by one year.

How we will handle this apparently temporary bulge of new children as it passes through our school system remains to be seen. With a static number of available teachers and classrooms, there is no other solution but more children in each class, if we continue to offer an educational program to each child. Alternatives of temporary classrooms, utilization of untrained teachers or assistant teachers, staggered classes, and extension of the school year through the summer months may be considered. An immediate, nation-wide recruiting drive for qualified teachers to come to California, encouragement of private programs through reimbursement legislation, and a stepped-up building program should also be considered.

A state-wide plan to improve the quality of education for hearing-impaired children in California has occupied the time and taken the energy of many educators during the past several years. With the threat of greatly increased numbers of deaf and hard-of-hearing children outside the gates, much of this plan may have to wait for implementation.

The second major educational problem is the increased complexity of the educational task. The increased number of multiple handicaps in this post-rubella population is probably greater than in any group we have previously seen. In addition to those obvious sensory or motor problems which are immediately presented, more subtle problems which adversely affect learning may manifest themselves at a later time during the child's education. Much that we traditionally do with "deaf"

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How we will handle this apparently temporary bulge of new children as it passes through our school system remains to be seen. With a static number of available teachers and classrooms, there is no other solution but more children in each class, if we continue to offer an educational program to each child. Alternatives of temporary classrooms, utilization of untrained teachers or assistant teachers, staggered classes, and extension of the school year through the summer months may be considered. An immediate, nation-wide recruiting drive for qualified teachers to come to California, encouragement of private programs through reimbursement legislation, and a stepped-up building program should also be considered.

A state-wide plan to improve the quality of education for hearing-impaired children in California has occupied the time and taken the energy of many educators during the past several years. With the threat of greatly increased numbers of deaf and hard-of-hearing children outside the gates, much of this plan may have to wait for implementation.

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children may have to be revised. The challenge is clear to our teacher training programs and to our school administrations to train teachers to meet unprecedented learning difficulties and to devise teaching situations which we have never tried before.

Comments and Recommendations:

The ambiguity of the data available leaves the school and clinic administrator without a firm means of predicting staff and facility needs for the future. Until our estimate of the number of children born deaf with rubella history can be validly based on reported incidence of rubella in the total population, or specifically in pregnant women, we will have to rely on the reporting of pediatricians, otologists, audiologists, and of hearing and speech facilities where these children are first tested. It is important that the California State Department of Education and the California State Department of Public Health work together on a project to determine the numbers of these children in advance of school entrance age. Surveys of speech and hearing centers and clinics, preschool programs, pediatric clinics, and private physicians should be undertaken now. Mandatory reporting of young deaf children by public school districts and private school authorities should be extended to include reporting by public and private speech and hearing clinics and centers. At best such surveys and reports will give only one or two years of planning time.

Special programs for blind children, deaf-blind children, speech and language defective children, and children with learning problems should be alerted to the wave of post-rubella children, now too young for special schools, who will be seeking special education in a few years. Follow-up studies of post-rubella children should be set up. Rubella damage may not show up immediately but be apparent when the

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child begins to learn to read or when language becomes highly complex. The Baylor Rubella Study Group in Houston has demonstrated how a cooperative approach to the multiple problems of rubella can be effective both from the standpoint of conducting a careful study and in mobilization of medical, paramedical, and educational services for early and comprehensive care.

Planning to meet the challenges of this massive increase of hearing-impaired and multiple-handicapped children should begin now. The task is formidable, but in these days of concern with sub-atomic particles and celestial exploration, surely we have the energy, the talent, the knowledge, and the inclination to deal with this problem, so near at hand.

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