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NATIONAL COMMUNICABLE DISEASE CENTER

RUBELLA

SURVEILLANCE

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE: PUBLIC HEALTH SERVIC
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION

PREFACE

Summarized in this report is information received from state and local health departments and other pertinent sources. Much of the information is preliminary. It is intended primarily for the use of those with responsibility for disease control activities.

Contributions to the Surveillance Report are welcome. Please address to:

National Communicable Disease Center
Atlanta, Georgia 30333
Attention: Chief, Investigations and Evaluations Section
Field Services Branch

National Communicable Disease Center	David J. Sencer, M. D., Director
Epidemiology Program	Alexander D. Langmuir, M. D., Director
Field Services Branch	John J. Witte, M. D., Chief George E. Case, M. S., Statistician JoDean F. Sanders, Statistical Assistant
Investigations & Evaluations Section*	Adolf W. Karchmer, M. D., Chief Elias Abrutyn, M. D. Joel P. Friedman, M. D. Ira Kassanoff, M. D. Thomas C. Shope, M. D.
*Also a part of Immunization Branch (State and Community Services Division)	F. Robert Freckleton, M. D., Chief

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
NATIONAL COMMUNICABLE DISEASE CENTER

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I. INTRODUCTION

Gregg's recognition of the etiologic relationship between rubella and a specific constellation of congenital defects, in 1941, established the clinical and public health importance of German measles. More recently, particularly after the 1964-65 pandemic, there has been further documentation of the severe teratogenicity of rubella. These observations have stimulated attempts to control the disease.

After the isolation of the rubella virus in 1962, efforts to control the disease were directed toward the development of a safe and effective vaccine. These endeavors led, in 1966, to the attenuation of the virus and subsequently to the development of live rubella virus vaccines. With the impending licensure of these vaccines, it is appropriate to review the available surveillance data for rubella.

II. RECENT TRENDS

A. Source of Data

Rubella and congenital rubella syndrome were officially placed on the list of notifiable diseases by the Conference of State and Territorial Epidemiologists in January 1966. Prior to this, many states had maintained surveillance for rubella and had voluntarily reported cases to the National Communicable Disease Center. Congenital rubella syndrome, however, was not reported prior to 1966.

In this report the data for the period prior to 1966 are those transmitted voluntarily by states. Data for rubella and congenital rubella syndrome since 1966 have been submitted to the NCDC in the weekly telegraphic report of notifiable diseases. Additional information characterizing rubella by age and sex was specifically solicited from state and municipal health departments where rubella has been consistently reported over the past decade.

There exists, at present, considerable variability in the completeness of rubella reporting, as well as in the type and accuracy of the information reported. This variability and the potential bias due to use of data collected from selected areas demand that the surveillance data presented in this report be interpreted with caution. Although not quantitatively accurate, these data do depict trends and patterns of rubella occurrence in the United States.

TABLE 1
REPORTED CASES OF RUBELLA BY STATES, 1959–1968

AREA	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959
UNITED STATES	**48,446**	**46,888**	**46,975**	**100,842**	**448,796**	**60,431†**	**37,265**	**43,810**	**50,958**	**76,417††**
No. States Reporting	(47)	(47)	(44)	(36)	(35)	(32)	(32)	(33)	(31)	(30)
NEW ENGLAND										
Maine	629	856	421	953	7,463	953	514	1,436	1,451	1,605
New Hampshire	92	214	133	163	1,331	453	57	217	163	1,374
Vermont	91	227	130	—	—	—	—	—	—	—
Massachusetts	3,608	1,429	2,056	2,839	37,105	11,739	3,766	6,443	5,562	4,258
Rhode Island	1,397	384	283	234	11,399	1,324	129	313	138	1,145
Connecticut	3,039	1,910	2,245	1,719	40,737	3,945	1,338	2,748	3,750	4,688
MIDDLE ATLANTIC										
New York	4,389	2,258	2,631	2,505	61,624	8,158	4,246	4,465	8,816	15,478
New Jersey	1,680	NN	—	—	—	—	—	—	—	—
Pennsylvania	208	179	114	—	—	—	—	—	—	—
EAST NORTH CENTRAL										
Ohio	2,099	771	1,254	2,348	19,194	2,953	979	1,607	3,621	2,954
Indiana	912	669	2,345	1,911	13,037	1,972	1,406	1,371	1,937	1,177
Illinois	3,355	1,621	2,935	4,850	29,685	2,108	2,030	3,438	1,723	2,146
Michigan	1,908	2,338	3,040	9,937	18,922	1,637	1,091	1,224	2,028	2,812
Wisconsin	2,980	3,340	5,446	9,570	96,583	4,731	4,365	5,418	4,841	7,075
WEST NORTH CENTRAL										
Minnesota	69	97	124	1,910	3,232	—	—	1	—	—
Iowa	2,053	1,896	1,952	3,798	18,481	1,727	416	482	438	1,254
Missouri	142	350	61	39	573	155	158	—	—	—
North Dakota	238	181	205	—	—	—	—	—	—	—
South Dakota	—	3	2	—	—	—	—	—	—	—
Nebraska	32	153	—	13	—	—	—	—	—	—
Kansas	128	16	NN	—	—	—	—	—	—	—
SOUTH ATLANTIC										
Delaware	150	84	55	111	802	135	144	276	38	102
Maryland	366	615	404	248	3,583	299	258	391	211	305
District of Columbia	14	9	15	16	455	149	17	50	44	43
Virginia	644	675	961	—	—	—	—	—	—	—
West Virginia	904	639	1,037	2,091	6,774	1,438	960	748	314	597
North Carolina	—	NN	—	—	—	—	—	—	—	—
South Carolina	259	231	284	—	†††	—	—	—	—	—
Georgia	—	784	493	285	497	85	315	34	140	69
Florida	1,491	1,174	1,447	892	8,661	1,008	501	732	834	953
EAST SOUTH CENTRAL										
Kentucky	861	2,141	1,960	1,190	18,027	2,158	914	2,034	1,696	874
Tennessee	1,135	1,367	2,578	—	—	—	—	—	—	—
Alabama	464	191	122	169	3,574	88	57	60	45	29
Mississippi	9	. . .	—	1,167	6,784	—	—	2	—	—
WEST SOUTH CENTRAL										
Arkansas	4	114	14	428	1,025	370	59	168	218	28
Louisiana	62	NN	—	—	—	—	—	—	—	—
Oklahoma	93	558	NN	—	—	—	—	—	—	—
Texas	2,923	640	140	—	—	—	—	—	—	—
MOUNTAIN										
Montana	96	200	376	2,526	2,367	898	1,011	747	783	1,675
Idaho	130	72	119	1,088	462	82	116	87	52	212
Wyoming	14	5	239	—	25	—	—	—	—	—
Colorado	892	1,885	785	1,973	11,817	1,219	1,729	1,803	1,549	3,567
New Mexico	134	309	113	272	351	109	26	41	142	969
Arizona	700	1,168	2,619	2,076	6,653	1,608	1,732	1,751	1,493	2,665
Utah	110	71	80	1,489	588	85	111	110	143	451
Nevada	—	425	30	22	—	—	—	—	—	—
PACIFIC										
Washington	1,851	3,377	3,435	25,258	11,119	5,526	5,152	3,176	4,230	10,625
Oregon	625	986	1,174	12,956	4,190	2,114	3,318	2,298	4,167	7,098
California	4,890	9,539	2,847*	—	—	—	—	—	—	—
Alaska	289	381	112	451	747	1,127	152	89	331	189
Hawaii	287	356	159	3,345	929	78	198	50	60	—

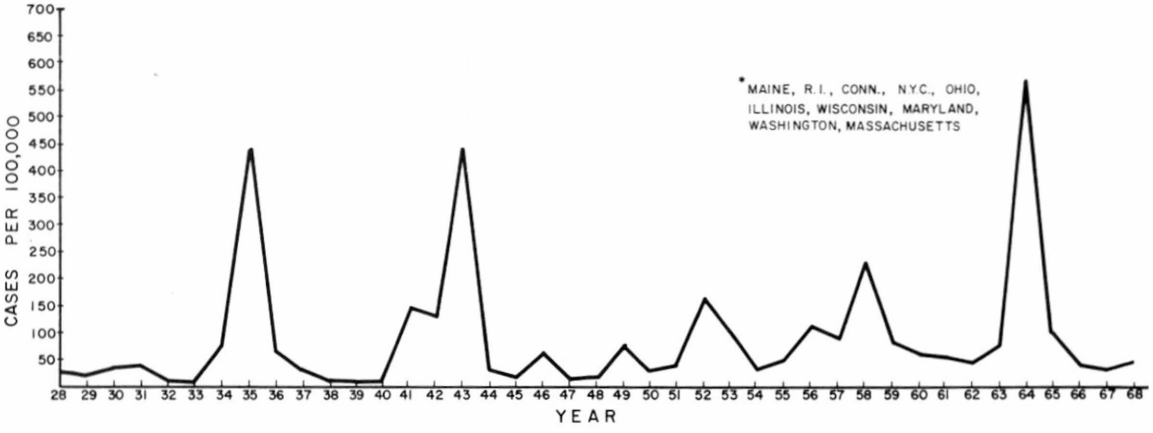
NN – Report not required by State Health Dept.
– No cases reported.
† Includes data for Maine from State Report.
†† Hawaii not included in U.S. total.
* Vol. reports prior to 11/66.
. . . Data not available
††† Included in measles.

Source: Reported Incidence of Notifiable Diseases in the United States; Annual Supplement for respective year.

B. Reported Rubella

Table 1 depicts the reported cases of rubella from states during the 10 year period 1959-1968. It reveals not only those states which did not report rubella, but also the variable number of cases reported during specific years from states in the same geographic region and with similar demographic characteristics. These discrepancies in the numbers of reported cases suggest the sporadic and incomplete nature of rubella reporting and re-emphasize the limitations of these data.

Figure 1
RUBELLA INCIDENCE
TEN SELECTED AREAS,* U.S.A.
1928–1968

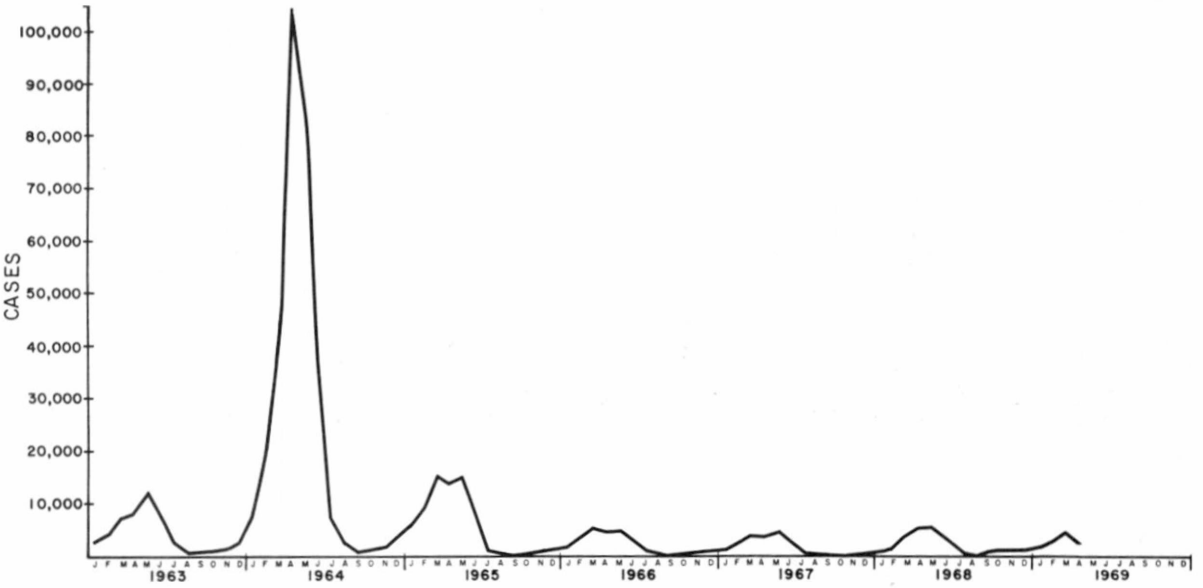


Considerable variation exists in the yearly incidence of rubella in 10 selected areas (Figure 1). These data suggest that major epidemics occurred throughout the country in 1935, 1943, and 1964, and that periods of high incidence were also observed in 1952 and 1958. These periods of increased rubella activity have occurred at six to nine year intervals. This moderately long and somewhat irregular cyclicity contrasts strikingly with the regular two year periodicity observed for rubeola in the United States prior to the large scale use of measles vaccine.

The examination of reported cases of rubella by four-week periods demonstrates the seasonal occurrence of the disease (Figure 2). The number of reported cases begins to rise in early winter; reaches a peak in March, April, and May; and falls to a low point in the late summer and autumn. This seasonal pattern is maintained during periods of relatively low rubella activity as well as times of major epidemics such as the one that occurred in 1964.

Figure 2

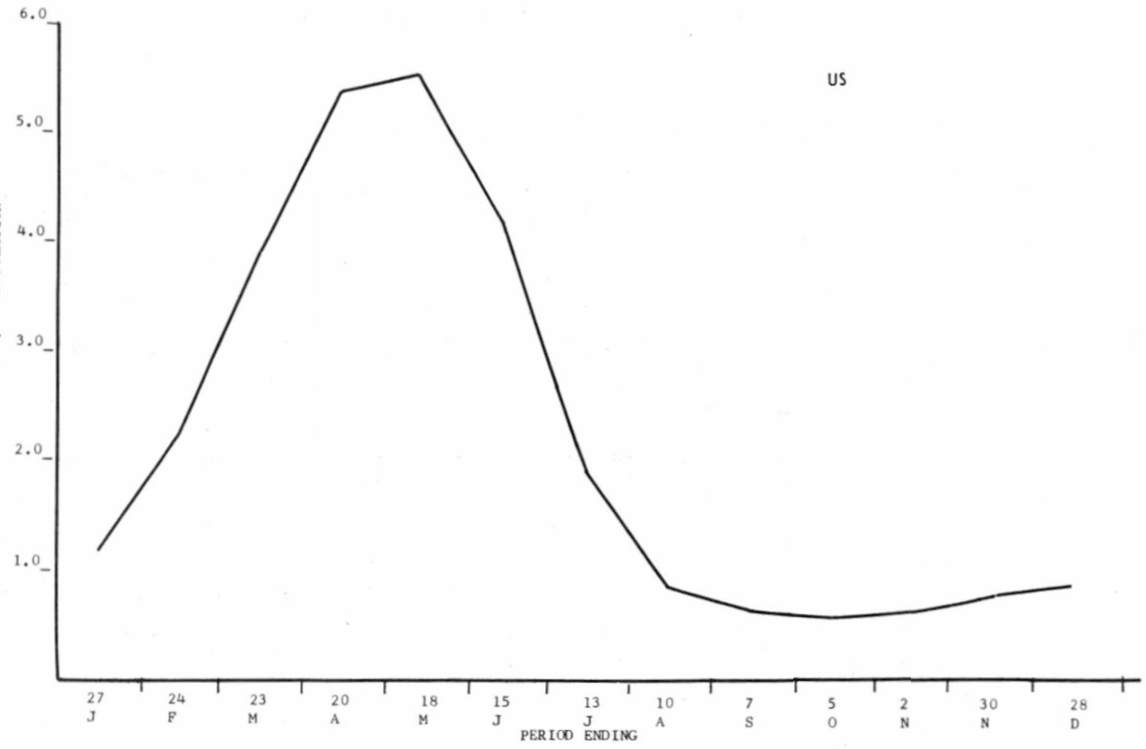
REPORTED RUBELLA CASES BY MONTH OF ONSET, 24 SELECTED STATES
· JANUARY 1963 — APRIL 1969



The uniformity of the seasonal pattern of rubella activity in the different regions of the United States is shown in Figure 3 and Table 2. The seasonal pattern in the individual regions is similar to that noted nationally: the number of reported cases peaks in the spring and falls to a low point in the late summer.

FIGURE 3

REPORTED RUBELLA CASE RATES -- UNITED STATES AND REGIONS - 1968



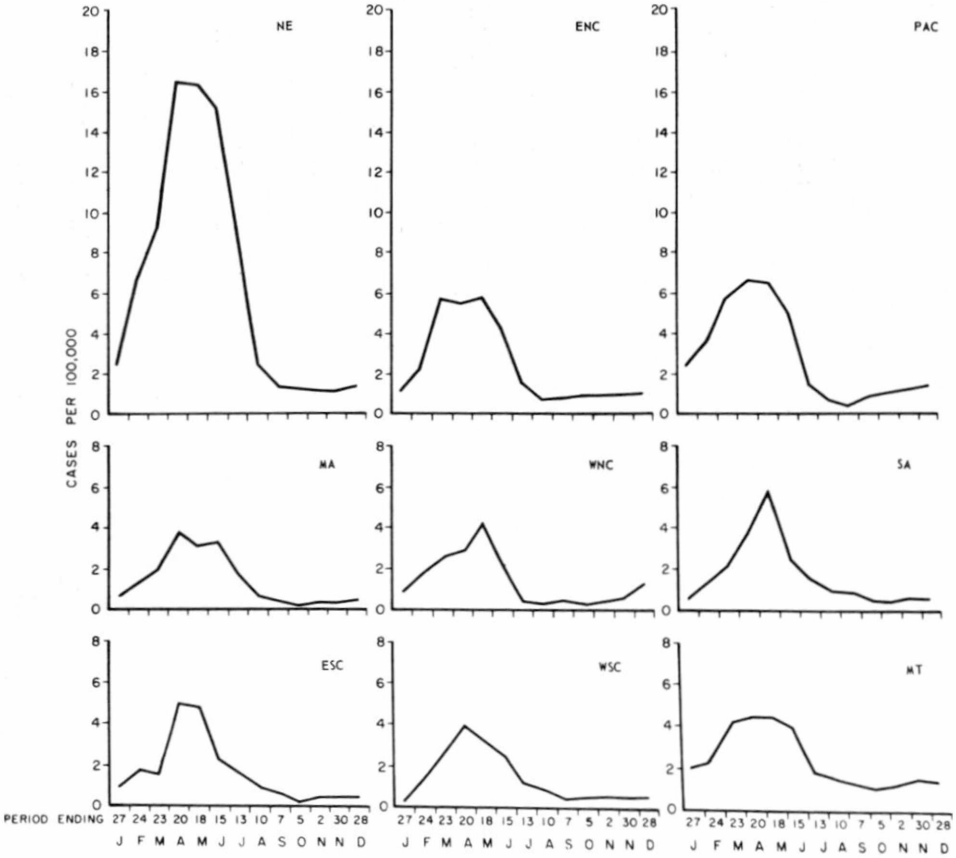


TABLE 2
REPORTED RUBELLA CASES BY 4-WEEK PERIODS, 1968

AREA	4-WEEK ENDING													Total 1968
	Jan. 27	Feb. 24	Mar. 23	Apr. 20	May 18	June 15	July 13	Aug. 10	Sept. 7	Oct. 5	Nov. 2	Nov. 30	Dec. 28	
UNITED STATES	**1,918**	**3,771**	**6,613**	**9,086**	**9,326**	**7,042**	**3,253**	**1,496**	**1,089**	**1,030**	**1,145**	**1,222**	**1,455**	**48,446**
NEW ENGLAND	**259**	**697**	**972**	**1,745**	**1,739**	**1,624**	**885**	**253**	**141**	**145**	**138**	**120**	**138**	**8,856**
Maine	34	31	97	61	143	108	54	15	13	24	32	13	4	629
New Hampshire	–	8	6	12	17	23	18	–	5	–	–	2	1	92
Vermont	2	8	15	10	6	20	4	13	4	2	–	2	5	91
Massachusetts	79	314	375	666	812	577	385	146	46	45	54	42	67	3,608
Rhode Island	32	68	79	443	248	283	162	44	13	13	3	7	2	1,397
Connecticut	112	268	400	553	513	613	262	35	60	61	49	54	59	3,039
MIDDLE ATLANTIC	**233**	**427**	**685**	**1,313**	**1,103**	**1,151**	**601**	**244**	**130**	**73**	**88**	**98**	**131**	**6,277**
New York City	109	152	305	569	603	615	347	146	75	43	33	32	29	3,058
Upstate New York	83	64	114	260	180	206	161	92	53	28	32	29	29	1,331
New Jersey	36	208	261	476	226	311	83	5	1	1	16	22	34	1,680
Pennsylvania	5	3	5	8	94	19	10	1	1	1	7	15	39	208
EAST NORTH CENTRAL	**394**	**838**	**2,024**	**2,006**	**2,048**	**1,509**	**569**	**265**	**263**	**336**	**330**	**326**	**346**	**11,254**
Ohio	44	101	218	441	507	528	101	23	29	26	20	36	25	2,099
Indiana	20	67	82	143	188	74	26	25	61	45	51	51	79	912
Illinois	54	224	1,125	761	560	203	168	26	29	97	24	34	50	3,355
Michigan	110	193	246	194	241	244	124	58	47	103	114	120	114	1,908
Wisconsin	166	253	353	467	552	460	150	133	97	65	121	85	78	2,980
WEST NORTH CENTRAL	**117**	**264**	**368**	**416**	**650**	**306**	**65**	**47**	**63**	**48**	**56**	**85**	**177**	**2,662**
Minnesota	6	15	10	9	7	10	1	1	–	–	6	3	1	69
Iowa	76	181	286	343	568	234	45	18	24	31	40	67	140	2,053
Missouri	1	1	27	6	25	30	7	18	8	5	1	–	13	142
North Dakota	19	23	27	31	28	30	6	8	22	9	8	8	19	238
South Dakota	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nebraska	2	2	4	4	2	2	1	2	8	1	–	2	2	32
Kansas	13	42	14	23	20	–	5	–	1	2	1	5	2	128
SOUTH ATLANTIC	**111**	**208**	**408**	**651**	**1,019**	**450**	**301**	**169**	**145**	**81**	**78**	**101**	**106**	**3,828**
Delaware	3	2	8	5	19	29	38	6	4	3	5	8	20	150
Maryland	9	24	112	45	60	49	20	4	10	9	7	7	10	366
District of Columbia	–	–	–	4	2	3	3	–	1	–	1	–	–	14
Virginia	20	85	95	89	126	71	44	37	22	7	12	25	11	644
West Virginia	39	50	60	137	189	110	66	71	70	35	24	23	30	904
North Carolina	–	–	–	–	–	–	–	–	–	–	–	–	–	–
South Carolina	7	5	43	76	85	6	8	2	3	2	4	7	11	259
Georgia	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Florida	33	42	90	295	538	182	122	49	35	25	25	31	24	1,491
EAST SOUTH CENTRAL	**106**	**196**	**187**	**597**	**577**	**269**	**187**	**112**	**78**	**30**	**39**	**43**	**48**	**2,469**
Kentucky	15	79	43	227	220	86	80	38	25	3	12	12	21	861
Tennessee	78	98	90	215	217	142	91	63	53	21	24	23	20	1,135
Alabama	13	19	54	155	140	41	16	11	–	6	3	5	1	464
Mississippi	–	–	–	–	–	–	–	–	–	–	–	3	6	9
WEST SOUTH CENTRAL	**53**	**223**	**440**	**661**	**538**	**407**	**179**	**139**	**96**	**65**	**89**	**80**	**112**	**3,082**
Arkansas	–	–	–	2	–	–	1	1	–	–	–	–	–	4
Louisiana	1	6	9	2	18	15	8	–	–	2	–	–	1	62
Oklahoma	2	14	12	17	–	3	–	3	12	–	9	5	16	93
Texas	50	203	419	640	520	389	170	135	84	63	80	75	95	2,923
MOUNTAIN	**134**	**150**	**281**	**296**	**292**	**253**	**124**	**97**	**83**	**77**	**84**	**108**	**97**	**2,076**
Montana	9	23	6	11	3	3	6	2	7	4	2	13	7	96
Idaho	58	2	8	6	4	15	4	4	8	8	7	3	3	130
Wyoming	5	3	1	4	–	–	–	–	–	–	–	–	1	14
Colorado	29	52	133	186	155	106	34	35	20	16	34	44	48	892
New Mexico	6	11	18	12	15	16	13	8	9	6	13	2	5	134
Arizona	26	51	94	74	106	101	59	45	33	41	23	27	20	700
Utah	1	8	21	3	9	12	8	3	6	2	5	19	13	110
Nevada	–	–	–	–	–	–	–	–	–	–	–	–	–	–
PACIFIC	**511**	**768**	**1,248**	**1,401**	**1,360**	**1,073**	**342**	**170**	**90**	**175**	**243**	**261**	**300**	**7,942**
Washington	167	219	470	257	248	185	10	8	4	47	54	92	90	1,851
Oregon	74	69	66	72	63	45	39	28	21	39	48	29	32	625
California	229	396	647	987	985	756	267	96	54	75	122	123	153	4,890
Alaska	33	49	23	34	15	56	9	19	7	8	10	6	20	289
Hawaii	8	35	42	51	49	31	17	19	4	6	9	11	5	287

– No cases reported.

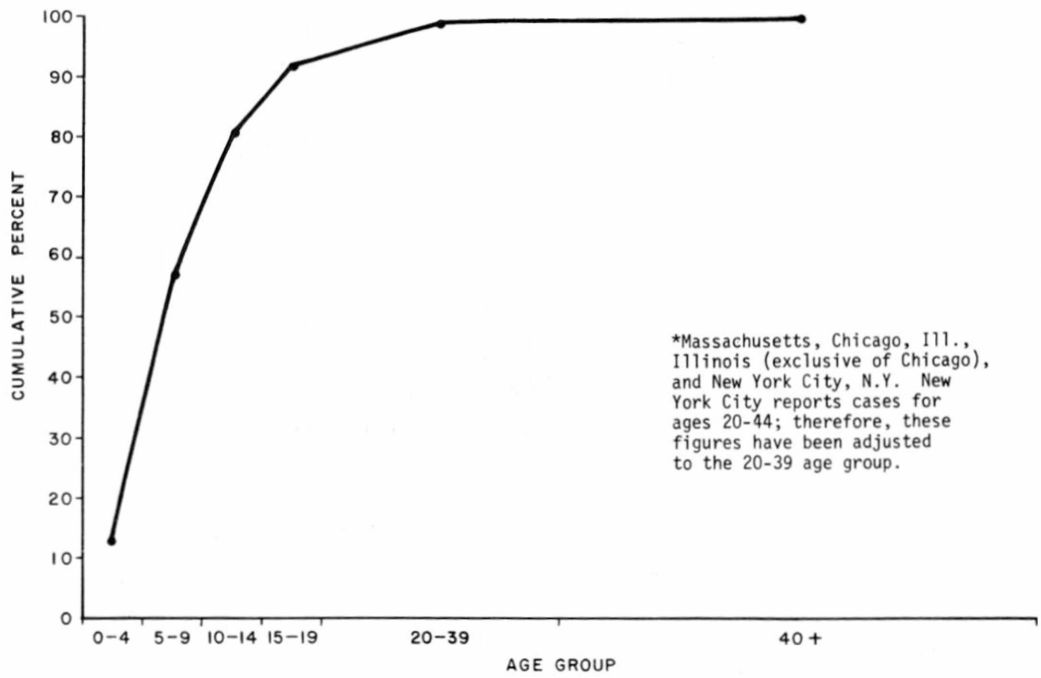
Source: Morbidity and Mortality Weekly Reports.

TABLE 3

REPORTED CASES OF RUBELLA BY AGE AND SEX
FOR SELECTED AREAS* -- 1963-1967

AGE	TOTAL			MALE			FEMALE		
	Number	%	Cum. %	Number	%	Cum. %	Number	%	Cum. %
0-4	16,373	13.5	13.5	8,218	14.3	14.3	8,155	12.9	12.9
5-9	52,078	43.1	56.6	25,660	44.5	58.8	26,418	41.8	54.7
10-14	28,403	23.5	80.1	13,483	23.4	82.2	14,920	23.6	78.3
15-19	14,527	12.0	92.2	7,446	12.9	95.1	7,081	11.2	89.5
20-39	8,100	6.7	98.9	2,541	4.4	99.5	5,559	8.8	98.3
40+	1,363	1.1	100.0	286	0.5	100.0	1,077	1.7	100.0
TOTAL	120,844			57,634			63,210		

FIGURE 4
CUMULATIVE PERCENT OF RUBELLA CASES BY AGE GROUPS
FROM SELECTED AREAS* - 1963-1967



The age distribution for reported cases of rubella is shown in Table 3. Most reported cases of rubella are from the 5-9 and 10-14 year age groups; in fact, approximately 66% of all reported cases occurred in these two age groups. The cumulative percent of reported cases by age indicates that 80% of reported cases had occurred by age 14, and 92% by age 20 (Figure 4). Nevertheless, significant numbers of cases were reported among young adults, particularly women.

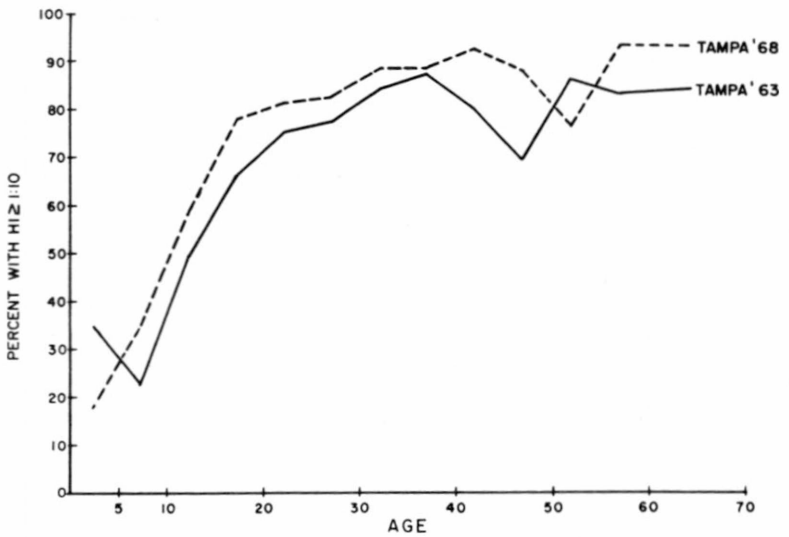
Although much rubella is reported among preschool children and adults, cases are most frequent among young schoolage children. Furthermore, estimates of age-specific rubella virus infection rates are highest in the 5-9 and 10-14 year age groups (1). Thus, both morbidity reporting and serologic data suggest that children in the 5-14 year age group play a major role in the propagation of disease in the community. Although not specifically demonstrated by epidemiologic studies, it is thought that rubella spreads primarily among the large group of susceptible children congregated in the elementary schools and that these children, in turn, transmit disease to preschool children and older individuals, particularly adults. Thus, although the age-specific infection rates and susceptibility patterns for rubella are somewhat different from those of rubeola, the hypothesized role of children in the spread of rubella is similar to that accepted for rubeola.

III. SEROEPIDEMIOLOGIC OBSERVATIONS OF RUBELLA

Since rubella reporting is incomplete and diagnostic accuracy variable, and since a significant proportion of rubella infections are subclinical, serologic data help to further delineate the epidemiology of this disease. A stratified random serosurvey conducted in March 1968 in Tampa, Florida, provides data concerning age-specific seroimmunity of 1,143 persons from 586 households (Figure 5). The percent of persons with rubella hemagglutination-inhibition (HI) antibody rises rapidly during childhood years and reaches a plateau during young adulthood. Among the 5-9 to 10-14 year olds, 35% and 59% of persons, respectively, had detectable HI antibody. However, 81% of young adults 20-29 years of age possessed antibody while serologic evidence of past infection was noted in 88% and 93% of persons in older age groups. Significant differences in detectable rubella antibody were not noted between males and females nor between persons in various socioeconomic groups (upper, middle, and lower).

FIGURE 5

RUBELLA HI ANTIBODY BY AGE OF SUBJECT
STRATIFIED RANDOM SURVEYS
TAMPA, FLA., MARCH 1963 AND JANUARY 1968



A stratified random serosurvey conducted in Tampa, Florida, in 1963 provides data on the serologic status of 887 persons in this population one year before the 1964 rubella pandemic. A comparison of the serologic status of the Tampa population one year before and four years after the 1964 pandemic is shown in Figure 5. The seroimmunity curves for the two years are similarly shaped; however, with the exception of those less than 5 and those 50-60 years old, the percent of persons with rubella antibody in 1968 is higher in each age group than that noted in 1963.

Between 1957 and the present, other studies utilizing either the neutralization or HI test yielded information on rubella susceptibility levels among women of childbearing age. In 1962, the susceptibility ratio for women of childbearing age seen in 12 medical centers in the United States was 17.5% (2). A repeat survey in 10 of the same medical institutions in 1966 revealed a decrease in serosusceptibility to 7.8% (3). Similarly, a nonrandom serosurvey among young adults in Montgomery County, Maryland, in 1957, found that 14.5% of persons were susceptible (4) while serologic examination of premarital and prenatal blood specimens from young adults in Maryland in 1967 demonstrated that less than 10% were susceptible to rubella (5). In addition, testing of premarital and prenatal blood specimens submitted to the Rhode Island State Health Department in 1967, demonstrated that only 10% of the tested specimens were devoid of detectable rubella antibody (6), while in a nonrandom serosurvey among female high school students in South Carolina only 15% were serosusceptible (7). On the other hand, serologic studies of rubella among island populations, suggest that susceptibility to this disease among adults, notably women, may be more prevalent than noted in the continental United States. Recent nonrandom surveys in Hawaii (8), Trinidad (9), Jamaica (10), and Puerto Rico (11) have found over 30 percent of those adults tested to be devoid of rubella antibodies. Because these studies represent various sampling techniques and were conducted in different areas, direct comparisons cannot be made. Nevertheless, several generalizations are suggested: (a) Susceptibility to rubella among adults appears to have been higher prior to the 1964 pandemic than afterwards - perhaps as much as 5% to 10% higher, (b) More importantly, rubella seroimmunity levels among adults in the continental United States are relatively high, reaching 85% or greater.

SURVEILLANCE OF CONGENITAL RUBELLA SYNDROME: A PROPOSED REGISTRY

The 1965 Conference of State and Territorial Epidemiologists made congenital rubella syndrome* a notifiable disease. Nineteen cases from 7 states were reported in 1966; in 1967, 9 cases were reported from 5 states, and in 1968, 6 states reported 6 cases. In 1968, the NCDC laboratory, testing specimens referred by state laboratories, confirmed a total of 10 cases of congenital rubella syndrome. Similar failure to report confirmed cases has occurred in previous years. No reliable indices of the magnitude of this entity exist at present.

The goal of rubella control programs is to prevent congenital rubella syndrome by vaccinating children, the primary reservoirs of infection; therefore, surveillance of congenital rubella syndrome as well as acute rubella is mandatory. In fact, the true measure of the success of rubella vaccination programs is their effect on the incidence of congenital rubella syndrome. Consequently, the 1969 Conference of State and Territorial Epidemiologists re-emphasized the importance of congenital rubella syndrome surveillance and recommended utilization of the individual case investigation approach. Accordingly, the NCDC is developing a National Registry for Congenital Rubella Syndrome to provide a current epidemiologic description of this disease, determine its public health impact, and provide a measure of the effect of vaccination programs.

As conceived, the current mechanism for disease reporting will be utilized. The state epidemiologist's weekly telegraphic report of notifiable diseases will supply morbidity data. Additional reports from individual case investigations will supply the information needed for the clinical and epidemiologic characterization of each case. To provide uniformity in case investigations, a simple case report form will be distributed. The completed form will include identifying information, sufficient laboratory and clinical data to substantiate the diagnosis, maternal rubella vaccination history, and information concerning educational and rehabilitation needs of the affected child. Therefore, in addition to case counts, data will be available to permit an epidemiologic description of the disease, to plan the development of remedial programs, and to guide future immunization programs.

*_Editorial Note:_ Diagnosis of congenital rubella syndrome can be established with reasonable certainty by laboratory tests on maternal and infant sera. In general, the presence of rubella antibody in specimens submitted when the suspect case is 6-12 months old confirms the diagnosis. Ideally, every case should be confirmed. If such serologic tests for rubella antibody are not available otherwise, specimens can be referred to the Virus Reference Unit, Laboratory Program, NCDC.

COST OF THE 1964-65 RUBELLA EPIDEMIC

by Steven Shavell, Economist, Office of Program Planning and Evaluation

The 1964-65 rubella epidemic was the most extensive in the United States since 1943. Estimates of morbidity with this usually mild exanthematous illness are striking (Table 4). Of particular importance is the large number of children (20,000) estimated to have been born with congenital rubella syndrome.

In addition to clinical illness, the impact of rubella during this epidemic can be measured in terms of time lost from gainful activities and the estimated dollar cost of the epidemic. Acute rubella in 1964-65 is calculated to have caused approximately 842,000 days of hospitalization, 3,500,000 lost workdays, and 14,400,000 missed schooldays. Estimated dollar cost can take two forms: direct and indirect. Direct cost includes medical expenses connected with treating all rubella-associated illnesses; it also includes charges for institutional care of severely retarded children and the cost of special education for those "rubella babies" who are retarded but educable. Indirect cost, on the other hand, is an estimate of the present and projected dollar value of productivity losses related to rubella and congenital rubella syndrome. These losses arise from premature death, physical disability, and temporary loss of time from work because of acute illness among the currently employed. The total estimated direct and indirect cost of the 1964-65 epidemic is 1.5 billion dollars (Table 5).

Direct rubella-associated expenditures are almost three times greater than the projected productivity losses resulting from the epidemic, and, the three greatest estimated costs are for special educational services, institutional care for retarded rubella babies, and direct medical care of children with the congenital rubella syndrome. The estimated excess cost of educating handicapped children was the single most important category of economic costs, $742,074,000. These estimates, in addition to the clinical sequelae of rubella, make explicit the full magnitude of the rubella epidemic.

TABLE 4

ESTIMATED MORBIDITY ASSOCIATED WITH THE 1964-65 RUBELLA EPIDEMIC

CLINICAL EVENTS		
Rubella Cases		12,500,000
Arthritis-Arthralgia		159,375
Encephalitis		2,084
Deaths		
Excess Neonatal Deaths	2,100	
Other Deaths	60	
Total Deaths		2,160
Excess Fetal Wastage		6,250
Congenital Rubella Syndrome		
Deaf Children	8,055	
Deaf-Blind Children	3,580	
Mentally Retarded Children	1,790	
Other Congenital Rubella Syndrome	6,575	
Total Congenital Rubella Syndrome		20,000
Therapeutic Abortions		5,000

TABLE 5

ESTIMATED ECONOMIC COSTS ASSOCIATED WITH THE RUBELLA EPIDEMIC OF 1964-65

DIRECT COSTS			
Acute Rubella			
Physicians' Services			
Office Care			
Acute Cases	$42,683,000		
Exposure	19,694,000		
Arthritis Cases	837,000		
Encephalitis Cases	21,000		
Hospital Care			
Arthritis Cases	5,853,000		
Encephalitis Cases	363,000		
Abortions (Spontaneous/Therapeutic)	2,266,000		
Total Physicians' Services		$ 71,717,000	
Hospital Services			
Arthritis Cases	33,531,000		
Encephalitis Cases	1,469,000		
Abortions (Spontaneous/Therapeutic)	946,000		
Total Hospital Services		35,946,000	
Total Acute Rubella			$107,663,000
Congenital Rubella Syndrome			
Medical Care		28,869,000	
Institutional Care		148,069,000	
Special Education*		742,074,000	
Total Congenital Rubella Syndrome			919,912,000
Miscellaneous - Drugs			120,000
TOTAL DIRECT COSTS			
INDIRECT COSTS			
Earnings Lost--Temporarily during illness			$ 80,575,000
Earnings Lost--Permanently Disabled *			251,548,000
Earnings Lost--Premature Death*			102,356,000
TOTAL INDIRECT COSTS			
TOTAL ECONOMIC COSTS			

*future years (discounted at 4%)

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RECOMMENDATION OF THE PUBLIC HEALTH SERVICE ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES

The Public Health Service Advisory Committee on Immunization Practices developed the following recommendation in close collaboration with the Committee on the Control of Infectious Diseases, American Academy of Pediatrics which endorses the recommendation. (Reprinted from the Morbidity and Mortality Weekly Report, Vol. 18, No. 15, Week Ending April 12, 1969.)

PRELICENSING STATEMENT ON RUBELLA VIRUS VACCINE

INTRODUCTION

The live, attenuated rubella virus vaccine* soon to become available appears to be a highly effective immunizing agent and the first suitable method of controlling rubella.

Rubella is generally a mild illness, but if the infection is acquired by a woman in the early months of pregnancy, it poses a direct hazard to the fetus. Preventing infection of the fetus is the principal objective of rubella control. This can best be achieved by eliminating the transmission of virus among children, who are the major source of infection for susceptible pregnant women. Furthermore, the live, attenuated rubella virus vaccine is safe and protective for children, but not for pregnant women because of an undetermined risk of the vaccine virus for the fetus.

RUBELLA

Rubella is one of the common childhood exanthems. Most cases occur in school-age children particularly during the winter and spring. By early adulthood, approximately 80 to 90 percent of individuals in the United States have serological evidence of immunity.

Rubella is clinically variable, and its common features, such as post-auricular and sub-occipital lymphadenopathy and transient erythematous rash, are often overlooked or misdiagnosed. A mild febrile illness may not be recognizable as rubella, and moreover, subclinical infection occurs, which further decreases the reliability of clinical history.

Complications of rubella are rare in children, but in adults, particularly women, the illness is commonly accompained by transient polyarthritis. Far more important is the frequent occurrence of fetal abnormalities when a woman acquires rubella in the first trimester of pregnancy.

RUBELLA IMMUNITY

Immunity following rubella appears to be long lasting, even after mild illness or clinically inapparent infection. The only reliable evidence of immunity is a positive serological test. However, because of the variation among reagents and technical procedures, results of serological tests should be accepted only from laboratories of recognized competency that regularly perform these tests.

At the present time, the hemagglutination-inhibition (HI) antibody determination is particularly useful for evaluating immunity. It is a rapid and sensitive procedure. The complement fixation (CF) and other serological tests are less useful.

LIVE RUBELLA VIRUS VACCINE

Live rubella virus vaccine is prepared in cell culture of avian or mammalian tissues. It is administered as a single subcutaneous injection. Although vaccinees shed virus from the pharynx at times for 2 or more weeks after vaccination, there is no clear evidence of communicability. Approximately 95 percent of susceptible vaccinees develop antibodies, but titers are lower than those observed following natural rubella infection. Recent investigations have shown that vaccination affords protection against illness following either natural exposure or artificial challenge.

Antibody levels have declined very little during the 3-year period of observation of children who were among the first to be immunized with rubella vaccine. Long-term protection is likely, but its exact duration can be established only by continued observation.

More than 30,000 susceptible children have received live rubella virus vaccine in field investigations, with almost no untoward reactions. Only rarely has transient arthralgia or evanescent rash been reported in children.

Many susceptible women have had lymphadenopathy, arthralgia, and transient arthritis beginning 2 to 4 weeks after vaccination; however, fever, rash, and other features of naturally acquired rubella have occurred less commonly. Not enough susceptible men have been vaccinated to show whether they experience comparable reactions as frequently as women.

*Its official name is Rubella Virus Vaccine, Live.

RECOMMENDATIONS FOR VACCINE USE

Live rubella virus vaccine is recommended for boys and girls between the age of 1 year and puberty. Vaccine should not be administered to infants less than 1 year old because of possible interference from persisting maternal rubella antibody.

Children in kindergarten and the early grades of elementary school deserve initial priority for vaccination because they are commonly the major source of virus dissemination in the community. A history of rubella illness is usually not reliable enough to exclude children from immunization.

Vaccination of adolescent or adult males is of much lower priority because so few are susceptible. However, the vaccine may be useful in preventing or controlling outbreaks of rubella in circumscribed population groups.

Pregnant women should not be given live rubella virus vaccine. It is not known to what extent infection of the fetus with attenuated virus might take place following vaccination, or whether damage to the fetus could result. Therefore, ***routine*** immunization of adolescent girls and adult women should ***not*** be undertaken because of the danger of inadvertently administering vaccine before pregnancy becomes evident.

Women of child-bearing age may be considered for vaccination only when the possibility of pregnancy in the following 2 months is essentially nil; each case must be considered individually. This cautious approach to vaccinating post-pubertal females is indicated for two reasons: First, because of the theoretical risk of vaccination in pregnancy; and second, because significant congenital anomalies occur regularly in approximately 3 percent of all births, and their fortuitous appearance after vaccine had been given during pregnancy could lead to serious misinterpretation.

If vaccination of a woman of child-bearing age is contemplated, the following steps are indicated:

Optimally, the woman should be tested for susceptibility to rubella by the HI test (See *Rubella Immunity*).

If immune, she should be assured that vaccination is unnecessary.

If susceptible, she may be vaccinated only if she understands that it is imperative for her to avoid becoming pregnant for the following 2 months. (To ensure this, a medically acceptable method for pregnancy prevention should be followed. This precaution also applies to women in the immediate post-partum period.) Additionally, she should be informed of the frequent occurrence of self-limited arthralgia and possible arthritis beginning 2 to 4 weeks after vaccination.

Use of Vaccine after Exposure to Natural Infection

There is no evidence that live rubella virus vaccine given after exposure will prevent illness. There is, however, no contraindication to vaccinating children already exposed to natural rubella. For women exposed to rubella, the concepts listed previously apply.

Precautions in Using Live Rubella Virus Vaccine

Pregnancy: ***Live rubella virus vaccine is contraindicated.*** (See *Recommendations for Vaccine Use.*)

Altered Immune State: Attenuated rubella virus infection might be potentiated by severe underlying diseases, such as leukemia, lymphoma, or generalized malignancy, and when resistance has been lowered by therapy with steroids, alkylating drugs, antimetabolites, or radiation. Vaccination of such patients should be avoided.

Severe Febrile Illness: Vaccination should be postponed until the patient has recovered.

Hypersensitivity of Vaccine Components: Rubella vaccine is produced in cell culture. Care should be exercised in administering vaccine to persons with known hypersensitivity to the species from which the cells were derived (indicated in the labeling). The vaccine contains a small amount of neomycin and should not be given to individuals known to be sensitive to this antibiotic.

Simultaneous Administration of Live Rubella Virus Vaccine and Other Live Virus Vaccines

Simultaneous administration of live rubella virus vaccine and other live virus vaccines should be deferred until results of controlled clinical investigations are available. Until then, it is recommended that rubella vaccination be separated by at least 1 month from administration of other live virus vaccines.

SURVEILLANCE

Careful surveillance of rubella infection is particularly important with an effective vaccine in use. Emphasis should be placed upon improved diagnosis and reporting of rubella, of the congenital rubella syndrome, and of complications of the disease. Competent laboratory investigation of all infants with birth defects suspected of being due to rubella is essential. It will likewise be important to observe patterns of vaccine use and determine their effectiveness.

Editorial Note: The recommended use of rubella vaccine in the prevention of congenital rubella syndrome represents a departure from the established practice of directly vaccinating the individual at risk. Protection of the pregnant woman is to be achieved by the vaccination of her contacts who are considered epidemiologically important in the spread of rubella. To be effective, this pattern of vaccine use must result in a major change in the ecology and the epidemiology of rubella in the United States. Agressive surveillance is needed to document that the proposed use of rubella vaccine does indeed result in these changes. It is paramount, therefore, that meaningful surveillance of rubella (and the congenital rubella syndrome), vaccine utilization, and vaccine efficacy be incorporated into plans for vaccine use. A deliberate and careful approach toward vaccination of the groups most epidemiologically important in the spread of rubella virus in the community should be encouraged.

SEROLOGIC TESTING FOR RUBELLA – A WARNING

The Public Health Service Medical Laboratory Services Advisory Committee issued the following statement on serologic testing for rubella.

Serologic tests for rubella are primarily used to determine: (1) the immune status of individuals in a given population; (2) the immune status of pregnant women who have been exposed to rubella; and (3) the etiology of cases of exanthematous disease. In the first instance, results of tests are used for epidemiological and immunization planning purposes; in the second and third instances, results are used to provide information for making medical management decisions in situations of some urgency.

At the present time the hemagglutination inhibition (HI) test is the technique most widely used for measuring rubella antibodies. This test is a complex procedure which must be performed by well trained, experienced individuals. In addition, a thorough knowledge of the immune response is essential for the proper interpretation of test results. Because of actions which may be taken on the basis of laboratory results, the need for accuracy is great, and certain problems associated with the HI test must be recognized.

The HI test for rubella is not a standardized technique, and several modifications of the basic procedure are in use. Methods for removing nonspecific inhibitors in serum specimens may not be completely effective, or they may remove specific antibody, leading to false positive or false negative results. Reagents obtained from different sources are not uniform in quality or in suitability for all modifications of the HI test. Since the products from each manufacturer are for use in a specific HI procedure, intermixing reagents from different sources can lead to problems in test performance. Further, the wide variability of erythrocyte suspensions has considerable bearing on the sensitivity of the test. Because of the lack of uniformity in testing procedures and reagents, interpreting laboratory results is a sophisticated undertaking, and, of necessity, may vary from one laboratory to another.

In view of the problems associated with this serologic procedure, HI tests for rubella should not be attempted in a laboratory carrying out the tests on an infrequent basis. Such a laboratory cannot maintain the necessary skills and controls, and, in urgent cases involving therapeutic abortion, pressures may lead to failure to repeat tests or to perform more difficult supplemental tests, such as complement fixation, fluorescent antibody, and serum neutralization tests, or IgM determinations which may be necessary for accurate interpretation.

The laboratory asked to carry out HI tests for rubella only infrequently or to perform supplemental tests for which it is not qualified should refer diagnostic materials to a State health department or other competent reference laboratory.

STATE EPIDEMIOLOGISTS

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, interpretation and transmission of data and epidemiological information from their individual States, the State epidemiologists perform a mast vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

Alabama	W. H. Y. Smith, M.D.
Alaska	Ralph B. Williams, M.D.
Arizona	Philip M. Hotchkiss, D.V.M. (Acting)
Arkansas	J. T. Herron, M.D.
California	Philip K. Condit, M.D.
Colorado	C. S. Mollohan, M.D.
Connecticut	James C. Hart, M.D.
Delaware	Floyd I. Hudson, M.D.
D. C.	William E. Long, M.D.
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Georgia	John E. McCroan, Ph.D.
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Idaho	John A. Mather, M.D.
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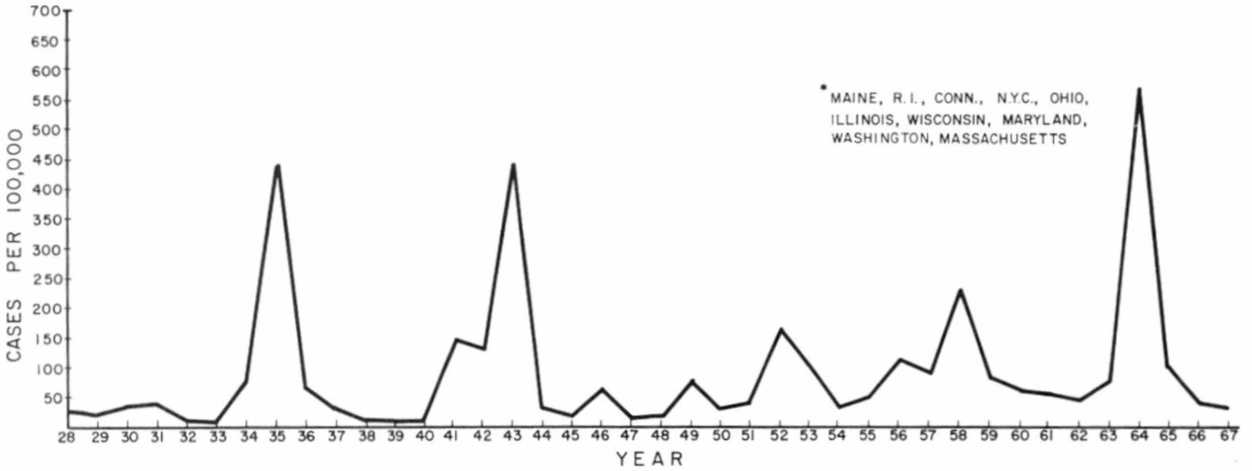
Wyoming	Herman S. Parish, M.D.

RUBELLA SURVEILLANCE IN THE UNITED STATES

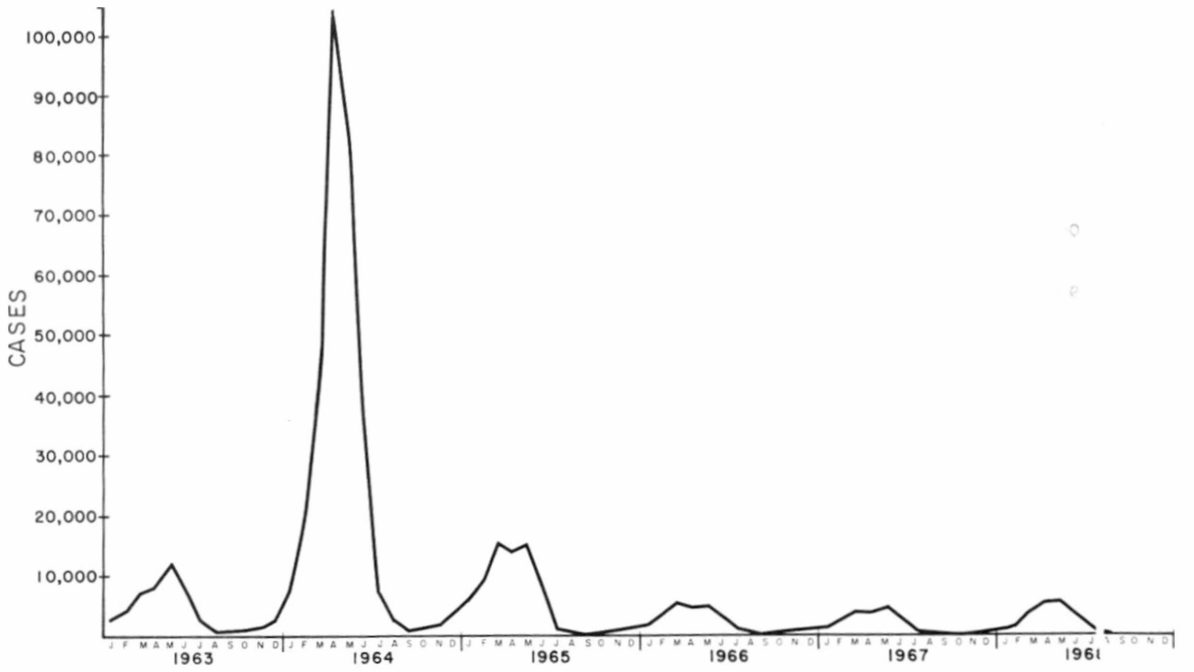
Prepared By
State Services Section
Epidemiology & Immunization Programs
National Communicable Disease Center

DHEW,PHS,HSM,NCDC

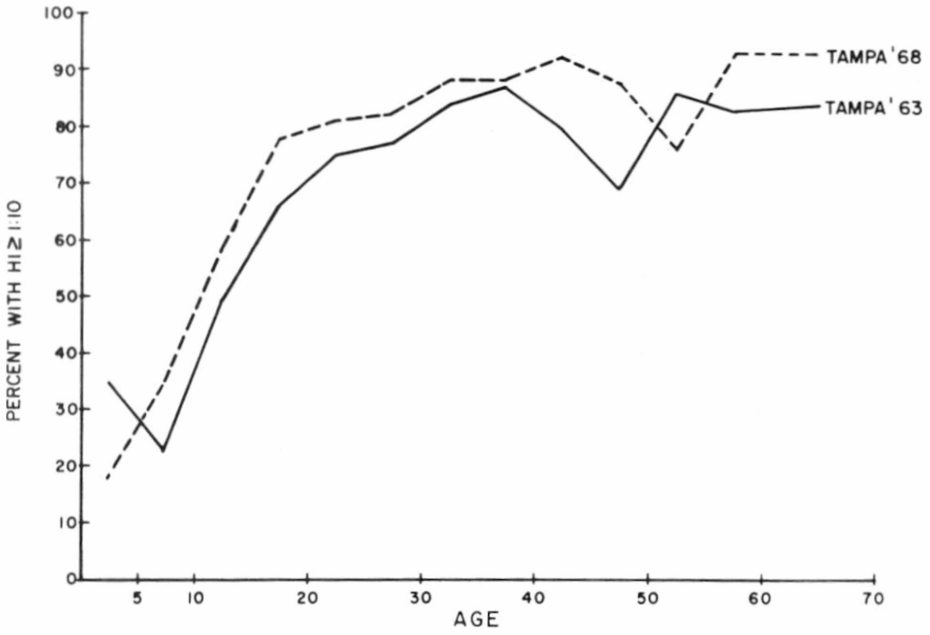
RUBELLA INCIDENCE
TEN SELECTED AREAS,* U.S.A.
1928–1967



REPORTED RUBELLA CASES BY MONTH OF ONSET, 24 SELECTED STATES
JANUARY 1963 – SEPTEMBER 1968



RUBELLA HI ANTIBODY BY AGE OF SUBJECT
STRATIFIED RANDOM SURVEYS
TAMPA, FLA., MARCH 1963 AND JANUARY 1968



AGE GROUP

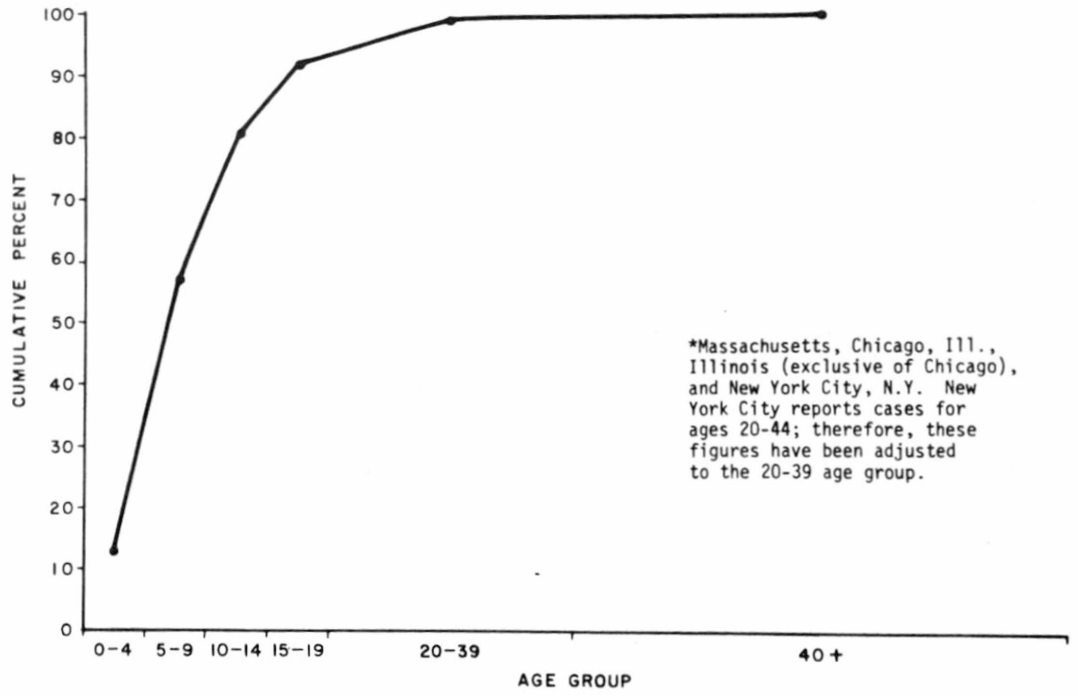
	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	≥60
ted	26	65	113	103	53	43	73	68	77	61	57	42	106
ibody	35	23	50	66	75	77	84	87	80	69	86	83	84
ted	34	132	143	99	73	67	64	66	68	93	69	77	158
ibody	18	35	59	78	81	82	88	88	92	88	76	93	93

REPORTED CASES OF RUBELLA BY AGE AND SEX

FOR SELECTED AREAS* - 1963-1967

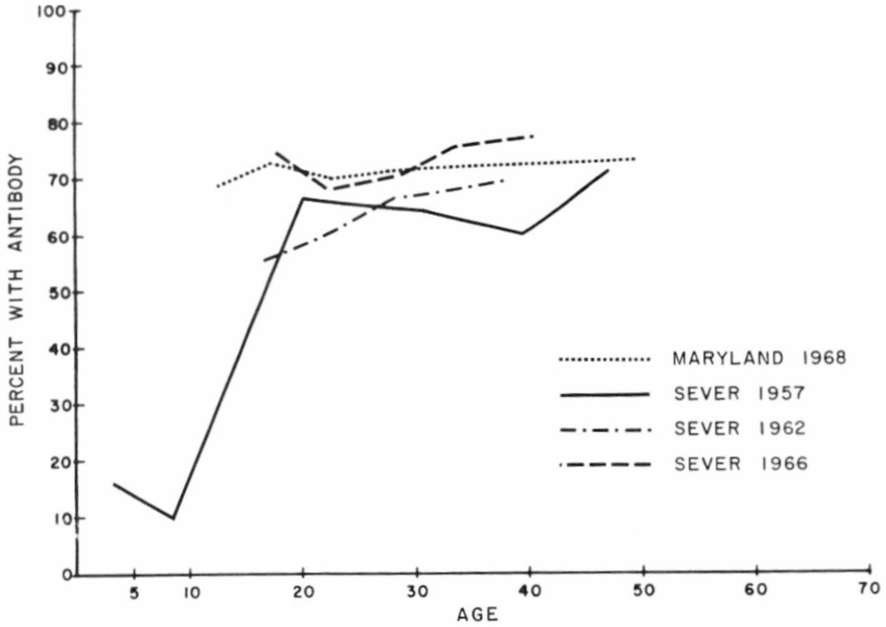
AGE	TOTAL			MALE			FEMALE		
	number	%	cum. %	number	%	cum. %	number	%	cum. %
0-4	16,373	13.5	13.5	8,218	14.3	14.3	8,155	12.9	12.9
5-9	52,078	43.1	56.6	25,660	44.5	58.8	26,418	41.8	54.7
10-14	28,403	23.5	80.1	13,483	23.4	82.2	14,920	23.6	78.3
15-19	14,527	12.0	92.2	7,446	12.9	95.1	7,081	11.2	89.5
20-39	8,100	6.7	98.9	2,541	4.4	99.5	5,559	8.8	98.3
40+	1,363	1.1	100.0	286	0.5	100.0	1,077	1.7	100.0
TOTAL	120,844			57,634			63,210		

CUMULATIVE PERCENT OF REPORTED RUBELLA CASES BY AGE GROUPS
FROM SELECTED AREAS* – 1963-1967



*Massachusetts, Chicago, Ill., Illinois (exclusive of Chicago), and New York City, N.Y. New York City reports cases for ages 20-44; therefore, these figures have been adjusted to the 20-39 age group.

RUBELLA ANTIBODY BY AGE OF SUBJECT
SELECTED NON-RANDOM SEROLOGICAL SURVEYS
U. S. A., 1957 – 1968



	SEVER '57[1]		MARYLAND '68[2]		RHODE ISLAND '67[3]		SEVER '62[4]			SEVER '66[5]		
AGE	#	%	#	%	#	%	AGE	#	%	AGE	#	%
1-5	11	36										
6-10	37	30										
11-15	38	54	89	88	7	86						
16-20	15	86	2616	92	179	90	14-19	115	75	≤20	171	94
21-25			3740	90	197	84	20-25	204	80	21-25	146	88
26-30	63	84	2235	91	80	86	26-30	116	86	26-30	78	90
31-35					44	98	31-44	165	89	31-35	38	95
36-40	78	80	1678	93	22	100				36-44	28	97
41-45					7	100						
≥46	19	91										

1. Neut. Test - Bloods from families with elementary school children and participants in influenza vaccine study (Ped. 35: 996, 1965)
2. HI Test - Prenatal and premarital specimens submitted to Maryland State Health Department Laboratory
3. HI Test - Bloods submitted for syphilis serology Rhode Island Department of Health, Division of Laboratories
4. Neut. Test - Bloods collected in collaborative cerebral palsy study - 10 hospitals, January-March (J. OB-GYN 23: 153, 1964)
5. HI Test - Bloods collected in collaborative cerebral palsy study - 10 hospitals, January-April '66 (J. OB-GYN 32: 365, 1968)