CONGENITAL MALFORMATIONS HYDATIDIFORM MOLES AND STILLBIRTHS IN THE REPUBLIC OF VIETNAM 1960-1969

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AND STILLBIRTHS

IN THE REPUBLIC OF VIETNAM
1960 - 1969

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SYNOPSIS-ABSTRACT

A ten-year survey of the incidence of stillbirths, bydatidiform moles and congenital malformations was conducted in the Republic of Vietnam using records maintained at 22 hospitals. The study collected 480,087 livebirths, 16,166 stillbirths, 2,866 moles and 2,355 malformations of all types. The military use of herbicides is depicted and the data are sorted into two time periods, pre- or light-spraying years (1960-65) and heavy-spraying years (1960-69). Comparing the earlier with the later period the stillbirth rate was 36.1 and 32.0, the mole rate was 6.6 and 5.6 and the malformation rate was 5.5 and 4.5 per 1000 livebirths. The survey is biased by data from population centers.

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INTRODUCTION

In 1969 Bionetics Research Laboratories reported an increase incidence of developmental abnormalities in rats and mice born of mothers which had received 2, 4, 5-trichlorophenoxyacetic acid (2,4,5-T) during early pregnancy (1). Because herbicides* containing this compound had been used for military purposes in the Republic of Vietnam (RVN), concern was expressed about possible similar effects in humans. To determine whether such effects could be shown in humans, the Ministry of Health, RVN, (MOH) and the US Military Assistance Command, Vietnam (MACV) undertook a cooperative study of obstetrical records over the 10 year interval 1960 - 1969 in 22 hospitals. This report describes the incidence of recorded congenital malformations, stillbirths, and hydatidiform moles in RVN before (1960 - 1965) and after (1966 - 1969) large scale military use of herbicides.

*Agent *Orange*, used in Vietnam defoliant operations, is composed of a 1:1 mixture of the n-butyl esters of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid.

METHODS

Evaluations of Obstetrical Records and Survey Procedures.

The initial efforts were directed to assess the availability and accuracy of obstetrical records in Vietnamese medical facilities, and to develop techniques for review and interpretation. A pilot study performed in seven provincial and district hospitals and one Saigon hospital (Tu-Du) revealed that Vietnamese obstetrical records were available and accurate, and developed reviewing techniques. The survey was then extended to other medical care facilities throughout the country.

Hospital Ledger.

In all but four hospitals, a Daily Summary Ledger, prepared by the chief midwives served as the primary source document. This contained 15-20 categories of information on each obstetrical or gynecologic patient. The following information was recorded: hospital admission number; patient's name, age, parity, and date of admission; presentation, time, and method of delivery; baby's sex, weight, and general condition at birth; placenta weight; estimate of blood loss; and name of person attending. A "remarks" column recorded such data as vacuum extraction, reversion, placenta delivery assistance, Caesarean section and indication, blood transfusion, uterine revision, maternal or infant complications with treatment and results, and, most germane to this study, congenital malformations. Some hospitals also included in the Ledger the patient's address and occupation, father's name and occupation, baby's name, date of discharge or departure prior to discharge, and whether patient paid for her care. The accuracy of the information in the Daily Summary Ledger in each hospital was tested by comparing it to the information in random samples of individual medical records. Several hundred such comparisons failed to reveal any discrepancies. No Daily Snmmary Ledger was kept at Hue, My Tho, or Tay Ninh; at these hospitals each individual obstetrical and gynecological record available was individually examined.

Records System at Tu-Du

A system of automatic data processing is used at Tu-Du Maternity Hospital in Saigon which was devised by a staff member trained in statistics in the United States and who has been chief of that medical records office for 12 years. The system uses manual coding of the information derived from the hospital records, transposition to punch cards and compilation. Eighteen malformation types are specified; these include all those commonly observed, the remainder are categorized as unspecified.

Criteria for Stillbirth, Malformation and Mole.

Abortions were distinguished from stillbirths by recorded fetal weight. Stillbirth was defined as fetuses weighing 750gm. or more and without evidence of life after complete separation from the mother. Only a few weighed less than 1000gm. In the rare case where fetal weight was not recorded, stillbirth was defined as a birth with a gestation period of twenty-four weeks or longer.

Malformations were counted in both livebirths and stillbirths. Malformations associated with abortions were not counted. More than one malformation was occasionally recorded for a single infant and these malformations were counted individually. In no case were more than three malformations recorded for a single birth. Hydatidiform moles were counted only if delivered.

Hospitals Surveyed

The location of each hospital visited is shown in Figure 1. All are Ministry of Health public hospitals and are free to those who do not desire or cannot afford to pay.

RESULTS

A total of 499,119 birth events were counted. There were 480,087 livebirths, 16,166 stillbirths, and 2,866 hydatidiform moles. Table 1 shows the location and type of hospital by geographic area, the years for which data were available and the number of livebirths counted. A small number of birth events for the years 1959 and 1970 were collected and are included in Table 1 for completeness. If these data are excluded, there are 488,852 total birth events, which include 470,200 livebirths, 15,812 stillbirths and 2,840 hydatidiform moles during the 1960-69 decade under consideration.

Figure 2 shows the number of livebirths collected by year. Hospitals outside the Capital contribnted the largest portion of the progressive increase in number of livebirths. Only a few hospitals had records for the entire decade. There is a relative lack of data for the first half of the decade. Before 1969, hospital records were kept for varying periods of time. Since 1969, MOH has required records maintenance for a minimum of five years.

The incidence of abnormal birth events by geographic area is shown in Table 2, and includes 1959 and 1970 data. All rates are expressed as per 1000 livebirths. Wide variations in some hospitals' annual incidence of all birth events were observed, and in some hospitals the rates were unrealistically low. Except in the smallest hospitals, variation in rates was usually greater between hospitals than the year-to-year variation within hospitals. Excluding the small district hospitals, stillbirth rates varied from 8.7 at Long Dien (4,214 livebirths over 7 years) to 62.7 at Qui Nhon (6,303 livebirths over 4 years). Hydatidiform mole rates varied from 1.4 at Tan An (24,596 livebirths

over 9 years) to 15.8 at Can Tho (16,056 livebirths over 4.3 years). Malformation rates varied from 1.1 at Tan An to 7.4 at Hue (5,271 livebirths over 2.3 years).

Table 3 presents annual birth abnormality rates for the years 1959 - 1970. If 1959 and 1970 data are excluded, the rates for the decade are: stillbirth - 33.6, moles -6.0, and malformations - 4.9. Figure 3 depicts the decline in the countrywide stillbirth rate, and the stable mole and malformation rates. The rates of stillbirths, moles and malformations for the four geographic areas are compared in Table 4.

Congenital Malformations.

Table 5 presents the 2,355 congenital malformations by type collected from all hospitals. Only obvious congenital malformations were recorded. Forty percent of all malformations were not specified by type in the Ledger nor in the individual medical records of the patients. Anencephaly, cleft lip/palate, clubfoot and hydrocephaly accounted for over 80% of all specified malformations. Congenital heart disease was not recorded nor were there autopsy reports on those infants who were dead at birth or died shortly thereafter. The hospital records do not distinguish between harelip and cleft palate, the general term "bec de lievre" being used for both malformations. Unusual deformities, such as those associated with thalidomide, were not reported.

Individual Hospital Data

Tables 9 through 29 present the birth defect data for each individual hospital surveyed.

Herbicide Usage in Vietnam.

Figure 4 shows the number of acres sprayed by year in Vietnam during the decade (3). Prior to 1966 there was comparatively little use of herbicides. Since 1966, more than 800,000 acres were sprayed annually. The birth defect data were grouped into pre- and light-spraying years (1960 - 1965) and heavy-spraying years (1966 - 1969). In Table 6 the data for these two periods are compared. The data for the years 1959 and 1970 are not included in this Table.

DISCUSSION

This study does not directly test a relationship between herbicides and birth abnormalities. Such an assessment would require prospective studies with examination of one population before and after exposure, or examination of two comparable populations with only one exposed to herbicides. Information about the precise dose of herbicide to which pregnant women were exposed and the week of pregnancy would be required. Careful examination and follow-up appraisal of all livebirths would be necessary to detect

the presence of inapparent malformations. All stillborn and infant deaths would require post-mortem examination. The dose of herbicide could then be related to embryological development of malformations. It is obviously impossible to carry out such a study.

This study has several biases. The first is that nearly all the information was derived from population centers and larger hospitals. In the six district hospitals visited (Tables 1 and 2) there were only 9857 livebirths with 86 stillbirths (a rate of 8.7), 3 moles (a rate of 0.3) and 14 malformations (a rate of 1.4). The two Saigon maternity hospitals contributed 59% of the data.

The second bias is the absence of data from private medical sources. There are several private hospitals in Saigon with large obstetrical departments and excellent standards of practice. Many other cities have private hospitals. All cities had several private "cliniques" usually directed by a single physician. Wealthier Vietnamese often attend these private hospitals, and the birth defect rates in this population might differ from those obtained in this survey. This is suggested by data from the Da Lat province hospital which has two classes of patients. One class, presumably wealthier, pays for obstetrical care. Both classes are served by the same obstetrical personnel and the same labor and delivery rooms. The only difference is assignment to different areas of the hospital for the post-partum period. The hospital maintains the records separately and the information was so collected and analyzed in this study (Tables 1, 2, 20, and 21). The paying class had lower stillbirth, mole and malformation rates.

The third bias is that the data are restricted almost exclusively to ethnic Vietnamese. There are a half million Chinese living in the Saigon/Cholon area and they use the six private Chinese hospitals in the area, none of which were surveyed. Montagnards as a rule do not enter district or province hospitals, but deliver at home.

Untoward events limited the availability of data at some hospitals. These include a mortar round exploding in the record room at My Tho in 1968, a flood in the record room at Qui Nhon in 1965, the loss of 1961 and 1962 Hung Vuong records which were borrowed for a medical school project, administrative disposition of record files before 1965 at Can Tho and Ban Me Thout and before 1967 at Pleiku and Tay Ninh, and finally the 1968 Tet Offensive when several hospitals became battlegrounds and some records were destroyed.

During the earlier part of the decade, some hospitals reported very few birth defects and hospital personnel frankly admitted incomplete reporting during those years. Most of the directors of the hospitals visited had been appointed within the past few years, and improvement in records keeping coincident with their assignment resulted in more complete reporting during the latter part of the decade. This has caused comparatively higher reported rates for recent years and in some hospitals the data suggest an upward trend when one actually may not exist; i.e., at Baria, Nha Trang, and Ban Me Thuot.

Changes in local obstetrical referral practices influence rates in specific hospitals. For example, those district hospitals near province hospitals began to refer problem cases to the province hospital when doctors with obstetrical training were assigned. Referral practice has been influenced by gradual improvement in roads, public trans-

portation, and security. The referral system accounts for the higher abnormality rates in province hospitals. This influence is also noted in the Capital area. For example, Tan An and Bien Hoa refer many problem and mole patients to the Tu-Du hospital in Saigon.

Rates are influenced by other factors. A study of moles begun in the Nha Trang hospital in 1968 resulted in a striking increase in the mole rate, probably due to more complete reporting and to the referral of a larger number of patients with suspected moles from surrounding districts.

The feasibility of relating the birth data collected to the quantity of herbicide sprayed by province by year was studied. Initially it seemed possible that abnormal birth event rates might be correlated to the amount of herbicide sprayed. The records for each aerial spray mission, including map coordinates of the area covered and the type and quantity of herbicide used, were made available by MACV. However, it was not possible to determine what proportion of any province's total yearly birth events are included in this survey. Neither the MOH Maternal and Child Health Program nor the birth registry system collect complete data. RVN officials estimate that currently only 70% of all births are reported to MOH and only 50% are reported as registered to the National Institute of Statistics. Our inability to obtain a consistent sample of birth events by province precluded meaningful correlation between spray and birth event data.

Comparisons of birth event data between countries are difficult because of variations in reporting procedures and differences in definitions of the various events. The incidence of stillbirths, moles, and malformations from studies in large Asian populations (4-13) is shown in Tables 7 and 8. The data from this study fall within the ranges reported by other workers.

CONCLUSIONS

Medical records at Vietnamese medical facilities were found to be sufficiently complete and accurate to compile birth events data for the decade of the sixties. Except in the Saigon area, there was frequent under-reporting of abnormal birth events particularly in the first part of the decade, resulting in unrealistically low rates in some hospitals for that earlier period.

This survey collected information on 480,087 livebirths, 16,166 stillbirths, 2,866 moles and 2,355 congenital malformations of all types from medical records maintained at 22 hospitals representing the Coastal, Interior, Capital and Delta geographic regions. There was a decline in the countrywide stillbirth rate and stable mole and malformation rates during the decade, weighted by the Saigon experience which contributed 59% of the data.

Meaningful correlation of any province's annual abnormal birth events to quantitative herbicide data was precluded by our inconsistent sampling of birth data.

Sorting the data into two time periods, before (1966-65) and after (1966-69) the large scale military use of herbicides, failed to show any influence of herbicides. Rather, a downward trend was observed in all categories of abnormal birth events. In comparing the earlier with the later period the countrywide stillbirth rate was 36.1 and 32.0, the mole rate was 6.6 and 5.6, and the malformation rate was 5.5 and 4.5. These rates are within the ranges reported for other Asian populations.

A natural variation was observed in the incidence of abnormal birth events as recorded during the decade. This variation was frequently of a greater magnitude between hospitals than the year-to-year variation within hospitals. The effect of any single variable (i.e., herbicides) cannot be demonstrated unless it changes this natural variation and is not masked by other variables. Such a change was not found in this survey.

Vietnam

Herbicides

Malformations

Moles

Stillbirths

TABLE 1. LOCATION AND TYPE OF HOSPITALS SURVEYED, YEARS OF DATA AVAILABILITY, AND NUMBER OF LIVEBIRTHS COUNTED

HOSPITAL	TYPE*	YEARS**	LIVEBIRTHS
Coastal Plain			
Long Dien	D	1962-70	4,375
Baria	P	1960-70	13,543
Nha Trang	P	1964-70	15,789
Qui Nhon	P	1966-69	6,190
Tuy Phuoc	D	1966-70	1,190
Da Nang	P	1967-69	13,061
Hue	P	1968-70	5,271
Hue Districts (3)	D	1967-70	3,553
Interior			
Tay Ninh	P	1967-69	6,947
Pleiku	P	1968-70	2,488
Ban Me Thuot	P	1966-70	5,808
Da Lat (Paying)	P	1960-70	4,658
Da Lat (Nonpaying)	P	1960-70	10,860
Capital			
Tu-Du Maternity Hospital	C	1960-69	182,450
Hung Vuong Maternity Hospital	C	1959-69	99,600
Bien Hoa	C(P)	1961-69	40,099
Delta			
Cai Rang	D	1969-70	740
Can Tho	P	1965-69	16,056
My Tho	P	1969	3,922
Kien Hoa	P	1964-70	18,891
Tan An	P	1961-69	24,596
TOTAL			480,087

*D = District, P = Province, C = Capital

** Data for 1970 restricted to the first 3-4 months

TABLE 2. INCIDENCE OF BIRTH ABNORMALITIES BY GEOGRAPHIC AREA

HOSPITAL	Rate* Stillbirths	Moles	Malformations
Coastal Plain			
Long Dien	8.7	0	1.8
Baria	26.2	1.9	2.7
Nha Trang	47.0	6.3	2.9
Qui Nhon	62.7	3.2	4.0
Tuy Phuoc	14.3	0.8	0.8
Da Nang	42.7	4.3	2.8
Hue	48.5	6.8	7.4
Hue Districts (3)	4.7	0.3	1.1
Interior			
Tay Ninh	37.9	6.3	1.4
Pleiku	27.7	2.4	0.8
Ban Me Thuot	43.6	2.1	0.9
Da Lat (Paying)	20.0	1.1	1.7
Da Lat (Nonpaying)	51.0	5.6	6.3
Capital			
Tu-Du	34.8	9.2	7.1
Hung Vuong	32.3	4.1	5.0
Bien Hoa	21.8	1.1	2.4
Delta			
Cai Rang	18.9	1.8	1.8
Can Tho	54.4	15.8	6.4
My Tho	43.8	10.4	4.6
Kien Hoa	30.3	1.7	1.2
Tan An	22.9	1.4	1.1
COUNTRYWIDE	33.7	6.0	4.9

*per 1000 livebirths

TABLE 3. INCIDENCE OF STILLBIRTHS, HYDATIDIFORM MOLES AND CONGENITAL MALFORMATIONS, BY YEAR

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate*	No.	Rate*	No.	Rate*
1959	3,258	125	38.3	9	2.8	11	3.4
1960	25,106	1,022	40.7	186	7.4	184	7.3
1961	24,355	919	37.7	164	6.7	121	5.0
1962	21,326	744	34.9	134	6.3	148	6.9
1963	33,060	1,153	34.9	207	6.3	187	5.6
1964	39,009	1,381	35.4	249	6.4	210	5.4
1965	46,821	1,632	34.8	318	6.8	202	4.3
1966	53,013	1,839	34.7	323	6.1	320	6.0
1967	69,844	2,159	30.9	359	5.9	276	3.9
1968	73,188	2,288	31.3	381	5.2	334	4.6
1969	84,478	2,675	31.2	519	6.1	341	4.0
1970	6,629	229	34.5	17	2.6	17	2.6
TOTAL	480,087	16,166	33.7	2,866	6.0	2,355	4.9

*per 1000 livebirths

TABLE 4. COMPARISON OF STILLBIRTHS, MOLES AND MALFORMATIONS BY GEOGRAPHIC AREA

Area	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate*	No.	Rate*	No.	Rate*
Capital	322,149	10,368	32.5	2,134	6.6	1,900	5.8
Coastal	62,972	2,371	38.6	240	3.8	192	3.0
Interior	30,761	1,232	40.0	128	4.2	93	3.0
Delta	64,205	2,195	34.3	364	5.7	170	2.6
TOTAL	480,087	16,126	33.7	2,866	6.0	2,355	4.9

*per 1000 livebirths

TABLE 5. TYPE, NUMBER, DISTRIBUTION, AND RATE OF CONGENITAL MALFORMATIONS OBSERVED IN 480,087 LIVEBIRTHS

Type	Number	Percent of Total	Rate*
Not specified	935	39.7	1.95
Anencephaly	525	22.3	1.09
Cleft lip/palate	452	19.2	0.94
Hydrocephaly	136	5.8	0.28
Clubfoot	81	3.5	0.17
Ventre batracien**	76	3.2	0.16
Monster	42	1.8	0.09
Umbilical	11	0.5	0.02
Achondroplasia	13	0.6	0.03
Polydactyly	8	0.3	0.02
Abnormal genitalia	8	0.3	0.02
Spina bifida	8	0.3	0.02
Evisceration	7	0.3	0.01
Hermaphrodite	6	0.3	0.01
Imperforate anus	6	0.3	0.01
Tumor	5	0.2	0.01
Ascites	4	0.2	0.01
Siamese twins	3	0.1	0.01
Malformation of legs	3	0.1	0.01
Large abdomen	3	0.1	0.01
Malformation of hands	3	0.1	0.01
Microcephaly	3	0.1	0.01
Syndactyly	2	0.1	0.01
Others (specified)	15	0.6	0.03
TOTAL	2,355	100.0	4.91

*per 1000 livebirths

**Enlarged abdomen with or without ascites

TABLE 6. COMPARISON OF BIRTH EVENTS DATA IN LIGHT-SPRAYING TO HEAVY-SPRAYING YEARS, COUNTRYWIDE AND BY GEOGRAPHIC AREAS

	Light-Spraying (1960-65)		Heavy-Spraying (1966-69)	
	No.	Rate*	No.	Rate*
Countrywide				
Livebirths	189,677	-	280,523	-
Stillbirths	6,851	36.1	8,961	32.0
Moles	1,258	6.6	1,582	5.6
Malformations	1,052	5.5	1,271	4.5
Coastal Plain				
Livebirths	12,580	-	47,347	-
Stillbirths	366	29.1	1,892	40.0
Moles	20	1.6	211	4.4
Malformations	27	2.1	148	3.1
Interior				
Livebirths	7,052	-	21,619	-
Stillbirths	360	51.0	794	36.7
Moles	39	5.5	85	3.9
Malformations	34	4.8	54	2.5
Capital				
Livebirths	151,726	-	167,165	-
Stillbirths	5,641	37.2	4,602	27.5
Moles	1,141	7.5	984	5.9
Malformations	965	6.4	924	5.5
Delta				
Livebirths	18,319	-	44,392	-
Stillbirths	484	26.4	1,673	37.4
Moles	58	3.2	302	6.8
Malformations	26	1.4	145	3.3

*per 1000 livebirths

TABLE 7. COMPARISON OF STILLBIRTH, MALFORMATION, AND ANENCEPHALY RATES AMONG ASIAN POPULATIONS

Country	Author	Period	No. Births	Stillbirth Rate*	Malformation Rate*	Anencephaly Rate*
Hong Kong	Hsu	1951-53	32,176	-	-	0.56
	Stevenson	1961-64	9,872	13.8	11.5	1.3
India	Sanghvi	1946-55	76,763	-	-	0.8
	Kolah	1960-63	29,553	25.9	14.0	0.9
	Stevenson (Bombay)	1961-64	39,498	43.7	8.6	1.5
	Stevenson (Calcutta)	1961-64	19,191	46.2	3.0	0.3
Indonesia	Suharjono	1962-67	15,018	-	5.7	1.0
Japan	Neel	1948-54	64,569	-	10.2	0.6
Malaysia	Stevenson	1961-64	15,937	25.2	10.4	1.0
Philippines	Jongco	1962-63	46,025	-	5.6	0.8
	Abad-Vasquez	1961-63	28,663	15.0	12.8	0.6
	Stevenson	1961-64	29,669	20.6	8.4	0.5
Singapore	Stevenson	1961-64	39,683	12.3	8.6	0.5
Taiwan	Wei	1955-62	14,834	-	8.7	1.2
Thailand	Siriraj Hosp.	1966	14,332	-	47.8**	0.4
Vietnam	Cutting	1960-65	180,884	36.1	5.5	1.1
		1966-69	249,779	32.0	4.5	1.0

*per 1000 livebirths
**All malformations, major and minor

TABLE 8. COMPARISON OF HYDATIDIFORM MOLE RATES AMONG ASIAN POPULATIONS

Country	Author	Rate**
Hong Kong	King*	1.8
Japan	Hasegawa*	4.3
Philippines	Acosta-Sison*	5.9
Taiwan	Wei*	8.0
Vietnam	Cutting 1960-65	6.6
	1966-69	5.6

*as reported by Marquez-Montes, et al.
**per 1000 livebirths

TABLE 9. LONG DIEN DISTRICT HOSPITAL

Year	Livebirths	Stillbirths		Moles	Malformations	
		No.	Rate*		No.	Rate*
1962	701	1	1.4	0	2	2.8
1963	101	1	9.9	0	0	-
1964	298	3	10.0	0	0	-
1965	747	10	13.4	0	2	2.7
1966	656	8	12.2	0	1	1.5
1967	601	6	10.0	0	1	1.7
1968	610	3	4.9	0	2	3.3
1969	508	3	5.9	0	0	-
1970 (1/3)	153	3	19.6	0	0	-
TOTAL	4,375	38	8.7	0	8	1.8

*All rates are expressed per 1000 livebirths

TABLE 10. BARIA PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1960	588	27	46	0	-	3	5.1
1961	1,368	38	28	0	-	4	2.9
1962	1,353	32	24	0	-	3	2.2
1963	1,303	27	21	1	0.8	1	0.8
1964	1,169	39	34	1	0.8	6	5.1
1965	1,334	41	31	3	2.2	3	2.2
1966	1,444	36	25	2	1.3	3	2.0
1967	1,659	32	19	9	5.4	2	1.2
1968	1,391	32	23	3	2.2	5	3.6
1969	1,562	41	26	6	3.8	4	2.5
1970 (1/3)	372	11	30	1	2.7	2	5.4
TOTAL	13,543	356	26.2	26	1.9	36	2.7

TABLE 11. NHA TRANG PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1964	1,507	61	40	5	3.2	1	0.7
1965	2,111	86	41	10	4.7	2	0.9
1966	2,113	132	62	4	1.9	14	6.7
1967	2,767	149	50	12	4.3	5	1.8
1968	3,168	146	46	22	6.9	8	2.5
1969	3,615	146	37	41	11.3	10	2.8
1970 (1/4)	508	22	43	6	11.8	6	11.8
TOTAL	15,789	742	47.0	100	6.3	46	2.9

TABLE 12. QUI NHON PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1966	1,178	60	51	0	-	1	0.8
1967	1,491	79	52	7	4.7	3	2.0
1968	1,772	133	75	6	3.4	10	5.6
1969	1,749	116	62	7	4.0	7	4.0
TOTAL	6,190	388	62.7	20	3.2	21	3.4

TABLE 13. TUY PHUOC DISTRICT HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1966	272	2	7	1	3.7	0	-
1967	260	4	15	0	-	0	-
1968	331	7	21	0	-	1	3.0
1969	260	3	11	0	-	0	-
1970 (1/3)	67	1	15	0	-	0	-
TOTAL	1,190	17	14.3	1	0.8	1	0.8

TABLE 14. DA NANG PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1967	4,620	174	38	16	3.5	13	2.8
1968	4,347	198	46	19	4.4	14	3.2
1969	4,094	185	45	21	5.1	10	2.4
TOTAL	13,061	557	42.7	56	4.3	37	2.8

TABLE 15. HUE PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1968	1,156	51	44	14	12.1	9	7.8
1969	2,837	132	46	20	7.0	21	7.4
1970 (1/3)	1,278	73	57	2	1.6	9	7.0
TOTAL	5,271	256	48.5	36	6.8	39	7.4

TABLE 16. HUE DISTRICT HOSPITALS

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
Cua-Huo							
1969	560	2	3.5	1	1.7	1	1.7
1970 (1/3)	178	0	-	0	-	0	-
Thanh-Noi							
1969	174	0	-	0	-	0	-
1970 (1/3)	212	0	-	0	-	0	-
Tay-Loc							
1967	783	6	7.6	0	-	1	1.2
1968	694	2	2.8	0	-	1	1.4
1969	675	4	5.9	0	-	1	1.5
1970 (1/3)	277	3	10.8	0	-	0	-
TOTAL	3,553	17	4.7	1	0.3	4	1.1

TABLE 17. TAY NINH PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1967(3/4)	1,818	55	30	8	4.4	4	2.2
1968	2,563	109	43	17	6.6	3	1.2
1969	2,566	99	39	19	7.4	3	1.2
TOTAL	6,947	263	37.9	44	6.3	10	1.4

TABLE 18. PLEIKU PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1968	840	20	24	4	4.7	2	2.3
1969	1,304	36	28	2	1.5	0	-
1970 (1/4)	344	13	38	0	-	0	-
TOTAL	2,488	69	27.7	6	2.4	2	0.8

TABLE 19. BAN ME THUOT PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1966	1,201	56	47	0	-	0	-
1967	1,417	57	40	0	-	0	-
1968	1,227	43	35	0	-	0	-
1969	1,292	60	46	9	6.9	5	3.9
1970 (1/3)	671	37	55	3	4.5	0	-
TOTAL	5,808	253	43.6	12	2.1	5	0.9

TABLE 20. DA LAT PROVINCIAL HOSPITAL - PAYING

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1960	236	5	21	0	-	1	4.2
1961	221	3	14	0	-	0	-
1962	232	3	13	0	-	0	-
1963	259	3	12	0	-	0	-
1964	760	18	24	2	2.6	2	2.6
1965	(data missing from hospital)						
1966	276	10	36	0	-	0	-
1967	624	15	24	1	1.6	1	1.6
1968	679	12	18	1	1.5	0	-
1969	947	12	13	1	1.1	3	3.2
1970 (1/2)	424	12	28	0	-	1	2.4
TOTAL	4,658	93	20.0	5	1.1	8	1.7

TABLE 21. DA LAT PROVINCIAL HOSPITAL - NONPAYING

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1960	704	51	72	12	17.1	2	2.8
1961	793	57	72	5	6.3	5	6.3
1962	852	41	48	4	4.7	8	9.4
1963	985	65	66	5	5.1	9	9.1
1964	943	36	38	5	5.3	5	5.3
1965	1,067	78	73	6	5.6	2	1.9
1966	1,092	56	51	7	6.4	8	7.3
1967	1.136	48	42	5	4.4	3	2.6
1968	1,261	58	46	3	2.4	11	8.7
1969	1,376	48	35	8	5.8	11	8.0
1970 (1/2)	651	16	25	1	1.5	4	6.1
TOTAL	10,860	554	51.0	61	5.6	68	6.3

TABLE 22. TU-DU MATERNITY HOSPITAL, SAIGON

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1960	12,350	535	43	145	12	138	11
1961	11,294	519	46	140	12	87	7.7
1962	11,482	517	45	122	11	123	11
1963	12,795	500	39	139	12	125	9.8
1964	17,099	637	37	182	11	142	8.3
1965	18,747	705	38	195	10	115	6.1
1966	19,429	691	36	189	9.7	166	8.5
1967	23,776	626	26	187	7.9	125	5.3
1968	26,675	699	26	188	7.0	138	5.2
1969	28,803	829	29	196	6.8	144	4.9
TOTAL	182,450	6,258	34.8	1,683	9.2	1,303	7.1

TABLE 23. HUNG VUONG MATERNITY HOSPITAL, SAIGON

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1959*	3,258	125	41	9	2.8	11	3.4
1960	11,228	404	37	29	2.8	40	3.6
1961**	4,608	133	29	16	3.5	14	3.0
1962**	238	6	25	0	-	2	8.4
1963	11,088	412	37	46	4.2	43	3.9
1964	8,693	366	43	44	5.1	40	4.6
1965	10,665	360	34	52	4.9	57	5.3
1966	11,349	366	32	50	4.4	79	7.0
1967	13,667	397	29	64	4.7	78	5.7
1968	12,257	308	25	38	3.1	72	6.0
1969	12,549	342	27	59	4.7	63	5.0
TOTAL	99,600	3,219	32.3	407	4.1	499	5.0

* Opened September 1959.
** Records borrowed and lost for this period.

TABLE 24. BIEN HOA PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1961	4,166	142	34	1	0.2	11	2.6
1962	4,344	108	25	6	1.4	7	1.6
1963	4,331	112	26	11	2.5	5	1.2
1964	4,371	96	22	5	1.1	8	1.8
1965	4,227	89	21	8	1.9	8	1.9
1966	4,056	84	21	1	0.2	12	3.0
1967	4,735	88	19	1	0.2	12	2.5
1968	4,811	91	19	7	1.5	21	4.4
1969	5,058	81	16	4	0.8	14	2.8
TOTAL	40,099	891	21.8	44	1.1	98	2.4

TABLE 25. CAI RANG DISTRICT HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1969	551	11	20	1	1.8	1	1.8
1970 (1/3)	189	3	16	0	-	0	-
TOTAL	740	14	18.9	1	1.3	1	1.3

TABLE 26. CAN THO PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1965 (1/2)	1,769	93	53	34	19	5	2.8
1966	3,650	163	47	55	15	25	6.8
1967	3,697	224	60	37	10	20	5.4
1968	3,498	210	60	54	15	32	9.1
1969	3,442	183	53	74	22	20	5.8
TOTAL	16,056	873	54.4	254	15.8	102	6.4

TABLE 27. MY THO PROVINCIAL HOSPITAL

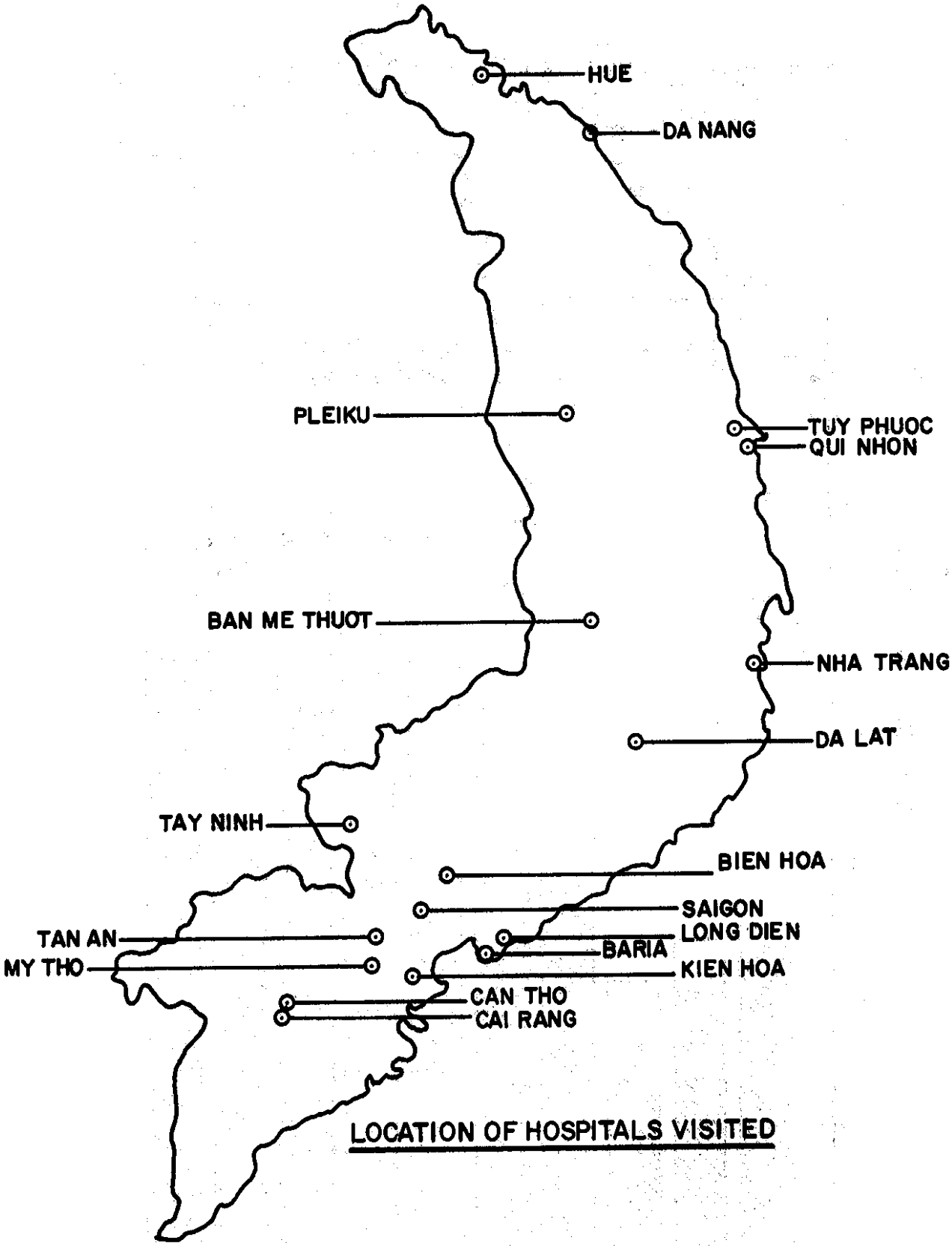
Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1969	3,922	172	43.8	41	10.4	18	4.6

TABLE 28. KIEN HOA PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1964	1,793	66	37	1	0.6	3	1.7
1965	3,079	75	24	3	0.9	6	1.9
1966	3,269	110	34	10	3.1	5	1.5
1967	3,564	108	30	6	1.7	4	1.1
1968	2,680	90	34	3	1.1	3	1.1
1969	3,201	89	28	6	1.9	3	0.9
1970 (1/3)	1,305	35	27	4	3.1	2	1.5
TOTAL	18,891	573	30.3	33	1.7	23	1.2

TABLE 29. TAN AN PROVINCIAL HOSPITAL

Year	Livebirths	Stillbirths		Moles		Malformations	
		No.	Rate	No.	Rate	No.	Rate
1961	1,905	27	14	2	1.0	-	-
1962	2,124	36	17	2	0.9	3	1.4
1963	2,198	33	15	5	2.3	4	1.8
1964	2,376	59	28	4	1.7	3	1.3
1965	3,075	95	31	7	2.3	2	0.6
1966	3,028	65	21	4	1.3	6	2.0
1967	3,229	91	29	6	1.8	4	1.2
1968	3,228	76	23	2	0.6	2	0.6
1969	3,433	81	23	3	0.9	2	0.6
TOTAL	24,596	563	22.9	35	1.4	26	1.1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TUY PHUOC
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NHA TRANG
DA LAT
TAY NINH
BIEN HOA
SAIGON
TAN AN
LONG DIEN
BARIA
MY THO
KIEN HOA
CAN THO
CAI RANG
LOCATION OF HOSPITALS VISITED

Figure 1

NUMBER OF LIVE BIRTHS COLLECTED, BY YEAR REPUBLIC OF VIETNAM, 1960 - 1969

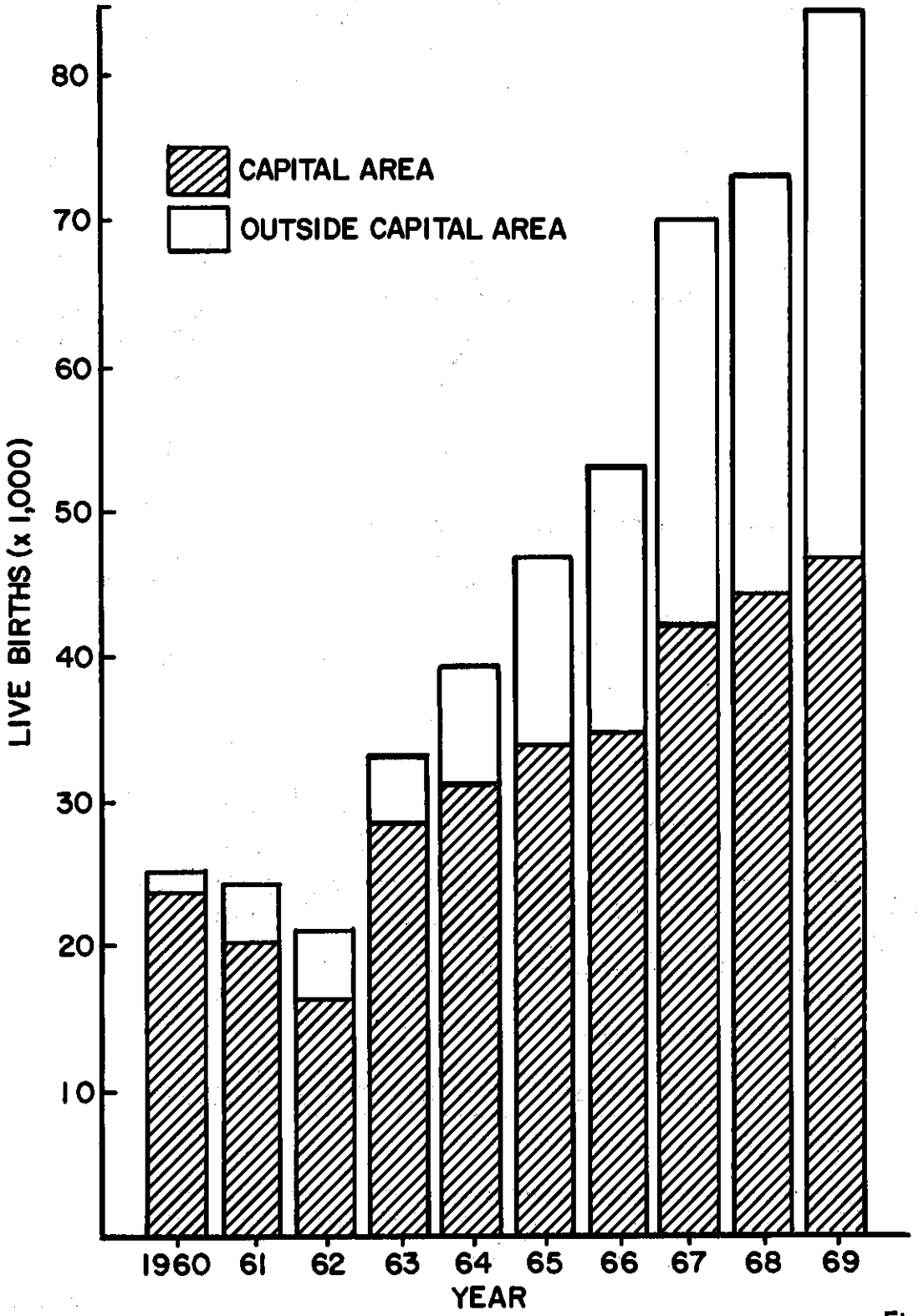

Figure 2

COUNTRYWIDE INCIDENCE OF STILLBIRTHS, MALFORMATIONS, AND MOLES PER 1000 LIVE BIRTHS PER YEAR 1960 – 1969

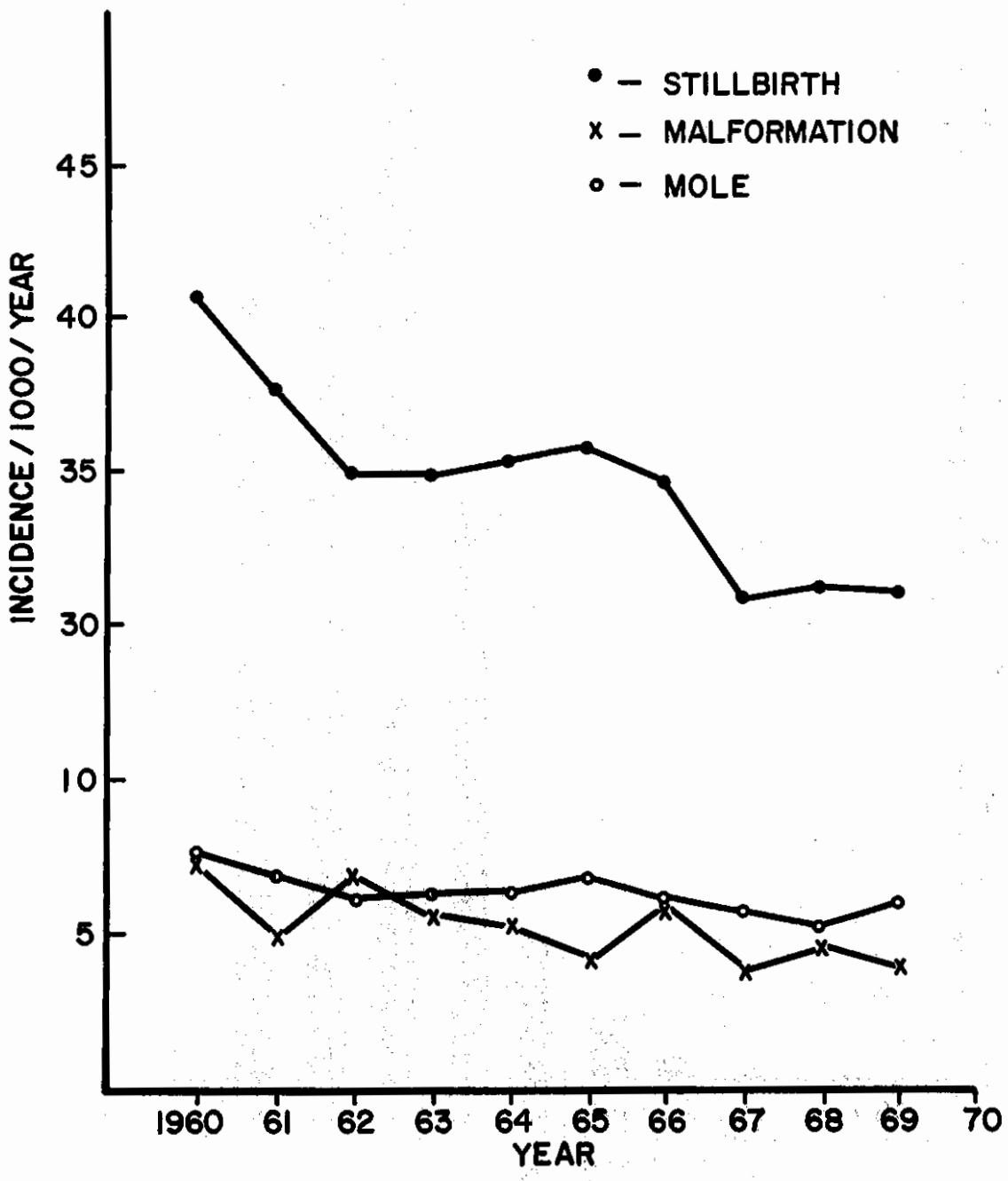

Figure 3

ACRES SPRAYED BY YEAR, REPUBLIC OF VIETNAM
1960-1969

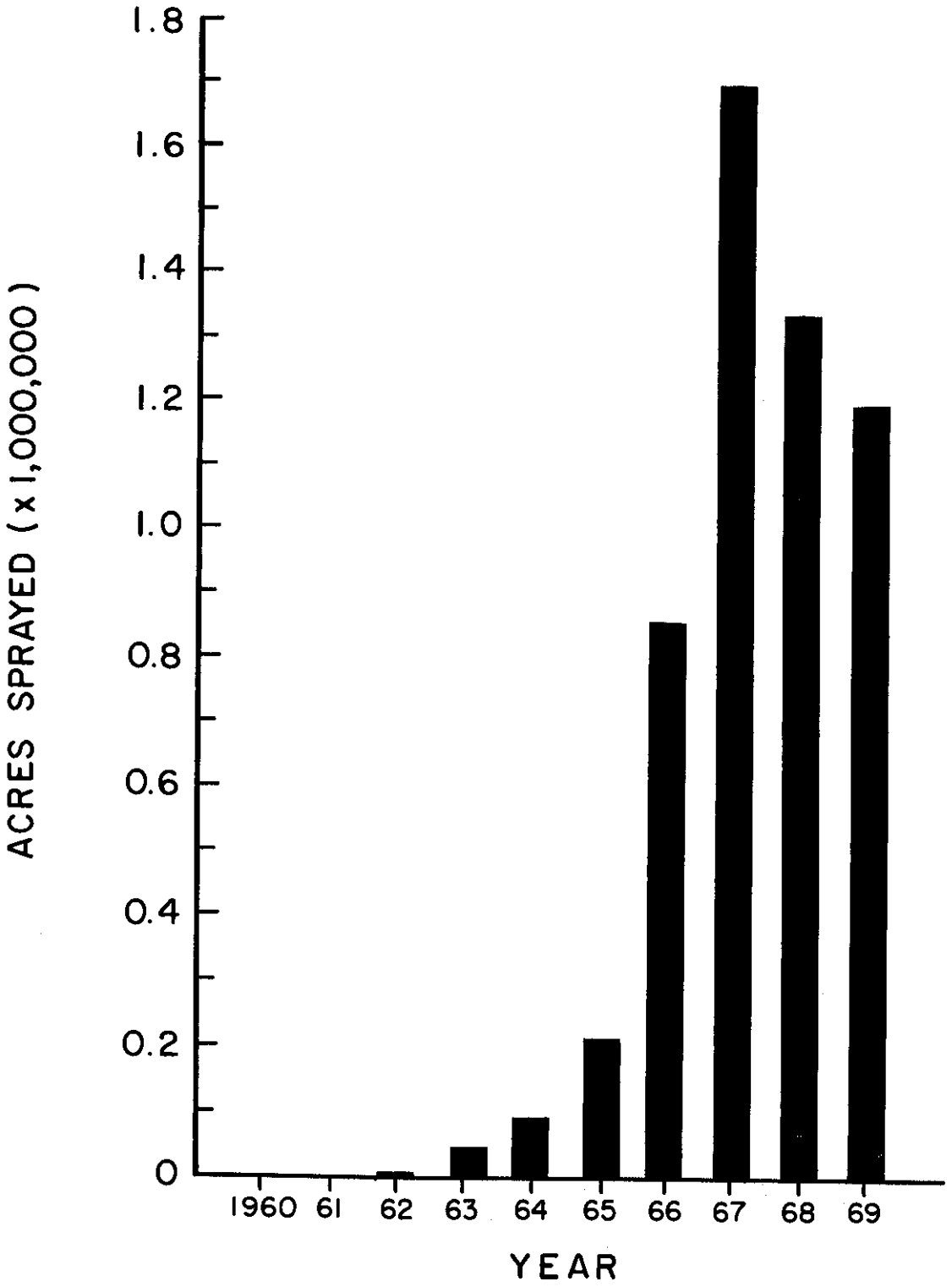

Figure 4

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