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Maternal Mortality in California

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■ *During the period August 1957 to December 1966, the Committee on Maternal and Child Care of the California Medical Association and the State Department of Public Health studied 1,219 deaths of women who died during or within 90 days of termination of pregnancy. Twenty-two percent of the deaths reviewed were considered unavoidable. Seventy percent had one or more avoidable factors; of these, 46 percent were attributed to errors in professional judgment, and 16 percent to inadequate prenatal care by the patient herself.*

Nearly one-third (383) of the 1,219 cases reviewed were deaths from non-obstetric causes. Of the 836 deaths from obstetric causes, 260 were attributed to abortion. Preliminary figures suggest a reduction in criminal abortion deaths corresponding to the increase in therapeutic abortions since 1968.

Over one-third of the deaths occurred in Mexican and Negro mothers. Death rate for Negro was triple that for white mothers. Despite the presence of four medical schools in District II (Los Angeles County), maternal death rates were 30 to 50 percent higher than in other districts due to the large urban black and Chicano population. One rural district with a large migratory agricultural population also had high rates.

WHERE ARE THE ORPHANAGES of yesterday? Undoubtedly the chief cause for their disappearance has been the phenomenal reduction in maternal mortality during the past 50 years. A maternal death is the ultimate tragedy in present-day obstetrics.[1] In the United States no death other than homicide is studied more fully than that of a pregnant woman.[2]

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The first report from an American maternal mortality committee came from Philadelphia in 1931, after which local societies in other cities and then states organized committees to review maternal deaths. A statewide California program officially began August 1, 1957, jointly sponsored by the California Medical Association and the California State Department of Public Health. Effective July 1, 1970, after 13 years of such partnership, both organizations terminated financial support due to reduced budgets. At present an ad hoc committee is searching for subsidies from

local obstetrical societies and county medical societies for continuation of maternal mortality study committees within the existing framework.

Within my lifetime the maternal mortality rate has decreased progressively. Reporting of deaths in the United States began in 1915, at which time 60 white women died per 10,000 live births and 100 non-white per 10,000 live births.[3] Approximately 50 years later, during the 1960's, maternal mortality rates had been reduced to 2.49 per 10,000 live births for white women and 10.13 per 10,000 for non-white women. These results can be attributed not only to improved obstetrical care, but also to advances in general medicine, nutrition and public health. However, until there is further improvement in such environmental and social problems as poor housing, malnutrition, unplanned pregnancies and inadequate total medical care, we will have more avoidable maternal deaths than occur in Sweden or our own New England States.[4]

California has a heterogenous population with so large a group of indigent or disadvantaged people that it is indeed remarkable that we have been able to reduce our maternal death rate to 2 per 10,000 live births within our present system of medical and obstetric care. Can we improve upon this in the future?

Material and Methods

For the purpose of the California study, maternal deaths include all deaths occurring during a uterine or extra-uterine pregnancy, abortion, labor, delivery or during the 90 days following termination of pregnancy. Each death is investigated by a consultant who files a special report form from which he omits the identity of the patient, the hospital and the attending physician. The case studies are then reviewed by a regional committee consisting of obstetricians, general physicians, a pathologist, an anesthesiologist and a public health physician.

The committee evaluates the cause of death, seeking to determine whether preventable factors, if any, were the responsibility of the physician, the patient or hospital facility. Results are coded by the State Health Department, after which the chairman of the California Medical Association's Committee on Maternal and Child Care may send a confidential appraisal by registered letter to the physician or hospital according to re-identification from the case study number.

TABLE 1.—*Maternal Deaths in California 1957-66*[13]

	Distribution by Race	*Birth Rate by Race*
White, Mexican	17.0%	18.0%*
White, other	57.6%	60.3%
Negro	20.0%	8.3%
Indian	1.1%	0.5%
Chinese	1.3%	0.7%
Japanese	1.7%	1.2%
Other	1.2%	1.0%

*Direct information not available. Estimate based on Spanish surname indicating Mexican origin and/or parentage.

TABLE 2.—*Maternal Death Rates by Race California 1930-68*[13]

Year	*Total*	*White*	*Negro*	*Other*
1930	52.5	52.3	63.1	53.7
1935	46.7	45.9	96.2	47.9
1940	28.4	27.8	64.4	27.7
1945	16.2	15.8	—	—
1950	5.5	4.8	14.4	10.0
1955	3.7	3.2	11.6	—
1960	2.9	2.3	7.4	6.5
1965	2.9	2.5	6.7	—
1968	2.0	1.6	4.2	4.6

Rates are per 10,000 live births

This is a report on 1219 maternal deaths studied jointly by the Committee on Maternal and Child Care of the California Medical Association and the State Department of Public Health during the period of August 1957 to December 1966. This presentation updates the seven previous reports[5-11] from the study committee.

Results

California holds midposition, 26th among the 50 states and District of Columbia, for report of a three-year average (1965-67) 2.62 maternal death rate per 10,000 live births.[12]

Table 1 shows that of those who have been identified at high risk over one-third are Mexican and Negro. Table 2 shows the high Negro maternal death rate has existed for many years. During the 11 years from 1958 through 1968, there was a decrease in annual live births from 348,965 to 339,221 (Table 3). This represents a decrease in birth rate from 23.7 to 17.1 (live births per 10,000 population). Maternal deaths decreased

TABLE 3.—*Birth Rates and Maternal Death Rates California 1958-68*[13]

	Live Births		*Maternal Deaths*		*U.S. Maternal*
	Number	*Rate (x)*	*Number*	*Rate (y)*	*Rate (y)*
1958	348,965	23.7	106	3.0	3.8
1960	371,525	23.4	107	2.7	3.7
1962	378,055	22.2	111	2.9	3.5
1964	374,441	20.5	105	2.8	3.3
1966	337,623	17.6	71	2.1	2.9
1967	336,584	17.3	95	2.8	2.8
1968	339,221	17.1	67	2.0	2.9
1969	352,937	17.3	72	2.0	na

(x) Per 1,000 population (y) Per 10,000 live births

TABLE 4.—*Maternal Death Rates for California and Maternal Mortality Study Districts, 1958-1967,*[13] *by Place of Occurrence*

Maternal Death Rates per 10,000 Live Births	*Statewide*	*District** I	II	III	IV	V
1958	3.0	3.3	3.2	2.9	2.4	2.6
1959	3.0	2.7	4.5	1.9	1.2	2.6
1960	2.9	1.8	3.6	2.2	3.1	4.3
1961	2.6	1.8	3.5	2.3	1.4	3.4
1962	2.9	3.1	3.6	2.1	1.7	3.9
1963	2.9	2.8	3.5	2.2	1.2	5.3
1964	2.8	2.3	3.9	2.0	2.1	2.3
1965	3.0	2.6	3.8	2.3	3.0	1.9
1966	2.0	1.7	2.8	1.7	1.1	1.5
1967	2.9	3.5	3.2	1.4	2.9	4.6
1968	2.0	1.3	2.3	1.4	3.2	2.6

*Maternal Mortality Study Districts by Geographical Area and Population, 1968

I. Southern (seven) Counties, except Los Angeles (4,422,900)

II. Los Angeles County (6,960,700)

III. Central Coast (twelve) Counties, including San Francisco Area (4,989,000)

IV. Superior (thirty) Counties, including Sacramento Valley (2,105,200)

V. West Central (seven) Counties (1,076,200)

TABLE 5.—*Maternal Mortality Case Investigations Completed August 1957-December 1966 California*[14]

Obstetric & Non-Obstetric Categories	*Total* *Number*	*Percent*
Certified Cause of Death	1,219	100.0
Abortion	260	21.3
Sepsis	109	8.9
Hemorrhage	85	7.0
Toxemic	75	6.5
Ectopic	54	4.4
Other Obstetric Cause	249	20.4
Accident	61	5.0
Other Non-obstetric Cause	322	26.4

from 106 in 1958 (3.0 per 10,000 live births) to 67 in 1968 and 71 in 1969 (2.0 per 10,000 live births). The exception in 1967 is unexplained. Despite the presence of four medical schools in District II (Los Angeles county) maternal death rates were 30 to 50 percent higher there than other districts due to the large urban black and Chicano population (Table 4). One rural district with large migratory agricultural population also had higher rates.

The largest number (383) of 1219 cases reviewed were not "obstetrical deaths" (Table 5), due to accident or other non-obstetric cause. Abortion (260) made up the second largest group, and when combined with 54 ectopic deaths, totaled 314, pre-viable obstetric deaths. The remaining 318 patients had a likelihood of carrying a viable child. Of these nearly one-half succumbed to the "three fatal horsemen," infection, hemorrhage and toxemia, despite antibiotics, blood banks and prenatal clinics. Other obstetric causes include malpresentations, cephalopelvic disproportion, inertia, lacerations, embolism and cerebral hemorrhage during the puerperium.

Twenty-two percent of the deaths reviewed were deemed unavoidable (Table 6). Seventy percent of maternal deaths resulted from one or more avoidable factors; of these, professional judgment error occurred in 46.2 percent, inadequate care by the patient 16.2 percent, and induced abortion in 18 percent of this group. It should be noted that some cases resulted from more than one avoidable factor, so the total of the percentage incidence exceeds 100 percent. Case studies ferreted out weak spots in the care of the non-obstetric as well as the obstetric deaths.

TABLE 6.—*California Maternal Mortality Avoidable Factors, August 1957-December 1966.*[14] *Obstetric and Non-Obstetric Categories**

	Total Number	Total Percent	Abortion	Other Obstetric	Non-Obstetric
Avoidable Factors	1,219†	100.0	260	576	383**
None	277	22.7	2	109	166
Inadequate Prenatal Care:					
Physician Only	39	3.2	—	29	10
Patient Only	198	16.2	32	112	54
Physician and Patient	38	3.1	1	24	13
Patient Error, Refusal	66	5.4	11	33	22
Induced Abortion	219	18.0	213	4	2
Judgment Error, Professional	563	46.2	74	366	123
Technical Error, Professional	93	7.6	4	68	21
Inadequate Hospital Facilities	73	6.0	8	53	12
Indeterminate	84	6.9	10	33	41

*Categories established by investigation of case
†Same case may show more than one factor
**Includes 186 cases in which pregnancy and labor were not directly responsible for death

Discussion

Results of the maternal mortality study reflect sociologic and economic as well as medical needs of the community. This study has again identified two high-risk pregnancy groups defined by race or culture. Previous reports[7,8] also identified older mothers (age 35 or over), those of high parity (four or more children) and county hospital health care recipients as high risk groups. Reviewers often commented that a death might have been prevented had the patient had access to effective contraception. Voluntary family planning programs which are known to be the most "cost effective" way to reduce maternal deaths from unplanned pregnancies are now more readily available to the uninformed and underprivileged. Women in the high-risk category need to be reached and educated in health and family life for safer childbearing and fewer unwanted pregnancies.

Abortion deaths may become almost extinct with increased availability and acceptability of family planning and therapeutic abortion. Statistical information from this study on deaths caused by criminal abortion was presented to the state legislature before the new abortion law was passed. The new abortion law has already apparently reduced the number of women admitted to our public hospitals because of septic abortions. Inquiry was made as to whether the new law had perceptibly affected maternal deaths in California. There was a total of only 139 deaths for 1968 and 1969 as compared with 166 for the years 1966 and 1967. Perhaps a more significant statistic is the change in maternal mortality specifically associated with abortion. I quote from a report by Dr. Edwin Jackson of the State Department of Public Health[15]:

"No therapeutic abortion deaths have been noted by the reporting hospitals through December 31, 1969. However, two deaths were identified in the Department's regular surveillance of maternal mortality based on death certificate review. This implies a mortality rate of 1 per 10,000 abortions, less than half the maternal mortality rate per 10,000 live births."

"There also continues to be a number of abortion deaths resulting from illegal procedures. In 1966 and 1967 combined there were 35 maternal deaths in which underlying cause of death was reported as criminal or self-induced abortion, resulting in a ratio of 0.5 deaths per 10,000 live births. There were an additional 13 deaths in which it was undetermined whether the abortion was induced or spontaneous as well as other deaths associated with criminal abortion but not reported as the underlying cause on the death certificate. Therefore, the deaths assigned to illegal abortion are understatements of the true associated mortality. In 1968 and 1969 the number of criminal (or self-induced) abortion deaths

fell to 22, a ratio of 0.3 deaths per 10,000 live births. This suggests a reduction in criminal abortion deaths corresponding to the increase in therapeutic abortions. Additional experience will be needed to confirm that this association is consistent and not the result of random variation."

Recognition that professional judgment errors accounted for the greatest number of avoidable factors has stimulated educational conferences, reports and exhibits[5-11] at state, county and local levels. A troubled community was benefited by our request that postgraduate training be brought to the doctors and hospital personnel by Regional Medical Planning. This project, consisting of regular visits of medical school faculty members, was continued for several months.

Inadequate prenatal care due to patient error (16.2 percent) should be an urgent concern for a society that sends extensive aid to developing countries throughout the world. The experiences of Project Hope and the Peace Corps in reaching *the people* can help us improve the lot of our own needy. The patient who neglects to seek prenatal care may have little knowledge of the health needs of pregnancy or the facilities available to her. Or she may be unable to leave her other children or job for a half day trip to a public clinic or doctor, or she may lack means or motivation to do so.

The expanding field of health care assistants will be of help in patient education as well as in patient care.

Conclusion and Recommendations

Although the maternal death rate in California has decreased to 2.0 per 10,000 live births for 1968 and 1969, one or more avoidable factors were found in more than 70 percent of the 1219 cases studied. There is room for improvement especially in the delivery of health care to the urban ghettos and to the rural migratory population. The Maternal Mortality Committee has identified the special needs of certain areas and has contributed to the continuing education of the physicians of the state.

Surveillance of maternal deaths should be continued by medical review committees of local medical societies functioning in the maternal mortality field. Legal mechanisms exist to protect confidentiality of such records.

REFERENCES

1. Hayden FJ: Maternal mortality in history and today. Med J Aust 1:100-109, 1970
2. Schneider J: Identification of high-risk pregnancy. OB/GYN Digest 12:31-37, 1970
3. United States Public Health Service, Vital Statistics of the United States 1961
4. Editor's comment on maternal mortality. Obstet and Gynec Survey 25:669, 1970
5. Montgomery TA, Lewis A: Maternal and perinatal deaths in California. Calif Med 93:302-305, 1960
6. Thompson WB (Chairman): Symposium on maternal mortality. Am J Obstet and Gynecol 83:1498-1515, 1962
   (a) Ravenscroft JS: Maternal mortality in California. Am J Obstet and Gynecol 83:1498-1501, 1962
   (b) Golenternek D: The function and operation of a district maternal mortality study committee. Am J Obstet and Gynecol 83:1501-1504, 1962
   (c) Fox LP: Disposition of avoidable factors in maternal mortality studies. Am J Obstet and Gynecol 83:1504-1509, 1962
   (d) Overstreet EW: Medical educational aspects of maternal mortality studies. Am J Obstet and Gynecol 83:1509-1512, 1962
7. Montgomery TA, Lewis A, Hammersly M: Maternal deaths in California, 1957-1962. Calif Med 100:412-421, 1964
8. Fox LP: Antenatal supervision—A review of obstetrical care with suggestions for reevaluation. Calif Med 101:168-173, 1964
9. Thompson WB, Montgomery TA, Ravenscroft JW: California maternal mortality survey—Exhibit 113th Annual Convention, American Medical Association, San Francisco, Calif, June 21 to 25, 1964
10. Thompson WB, Budd JW: Erroneous diagnoses of amniotic fluid embolism. Am J Obstet and Gynecol 91:606-620, 1965
11. Fox LP: Abortion deaths in California. Am J Obstet and Gynecol 98:645-651, 1967
12. Health, Education, and Welfare, United States Public Health Service, Vital Statistics of The United States 1967: Vol II, Mortality, Part A, 1969
13. State of California, Department of Public Health: Birth and Death Records
14. State of California, Department of Public Health: Joint Maternal Mortality Records
15. Jackson EW: Personal communication

CANCER FELLOWSHIPS

Postgraduate Fellowships in cancer for practicing physicians are available at the University of Southern California School of Medicine and the Los Angeles County-University of Southern California Medical Center. These Fellowships are sponsored by the National Cancer Institute, are of one month's duration and carry a stipend of $750. Separate programs are available in gynecological oncology, medical oncology, radiation therapy, tumor pathology and tumor surgery. Applicants should be Board eligible or Board certified and should submit a resumé of their professional background to Arthur J. Donovan, M.D., Program Director, Cancer Training Program, School of Medicine, University of Southern California, 2025 Zonal Avenue, Los Angeles, California 90033.