

FETAL-INFANT MORTALITY REVIEW REPORT

SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

Maternal, Child and Adolescent Health Section

Office of MCAH Medical Director

OCTOBER 22, 2008

Ellen J. Stein, MD, MPH, Medical Director, MCAH Section

Randy Reiter, PhD, MPH, Epidemiologist

Al Abramowitz, MS, Sr. Epidemiologist

30 Van Ness, Suite 260
San Francisco, CA 94102
Tel. (415) 575-5676
Fax. (415) 575-5799

INTRODUCTION

Fetal and infant mortality, the number and rate of fetal and infant deaths in a given community, is an important and sensitive indicator of the health of our mothers and children, and thus of our population overall. The MCAH section of SFDPH is developing systems to identify these deaths, to monitor their incidence and distribution across our population, and to review the available records in order to promote improved birth outcomes through clinical, systems, agency, and social/community practices.

We believe that the appropriate review of fetal and infant deaths includes both analysis of vital records as well as case reviews by clinicians, agencies, and the community. This report describes the development in recent years of the bases for and methods used in these investigations.

Since 2005, SF MCAH has been rebuilding its case and epidemiological review process. We have developed mechanisms for physician experts to provide medical reviews of most or all fetal and infant deaths to SF residents occurring in SF city and county. These clinical reviews are part of a larger infrastructure of case reviews, which includes those of the MCAH community review team and the medical examiner's selected death case review team.

We report here background epidemiological data on fetal and infant deaths from vital records files for 1999 through 2006. We then present selected descriptive data produced during the course of the development and implementation of the clinical review process since 2005, followed by a description of the development of the clinical review process itself.

The analysis in this report and the revitalization of our review processes provide the fundamentals for proceeding with a robust fetal and infant mortality review process in San Francisco.

BACKGROUND:

RECENT FETAL AND INFANT MORTALITY IN SF

We present the most recent available data as background to our report on recent FIMR process and results. These analyses come from three different datasets: (1) California Death Statistical Master Files and California Fetal Death Statistical Master Files for San Francisco, 1999-2006; (2) California Linked Birth-Death Cohort Files for Bay Area region, 1999-2001; and (3) SFDPH MCAH Fetal and Infant Death Database, developed internally by SFDPH for 2005-2007. Each is explained as it is presented, and a summary of their contents and differences is presented in the Appendix.

VITAL RECORDS FILES: FETAL AND INFANT DEATHS, 1999-2006

These are vital records data on SF resident fetal and infant deaths from 1999 through 2006, by type (fetal or infant), sex, ethnicity, age (fetal gestational age at death, birth to age at death for infants), and underlying causes of death.

SF resident fetal and infant deaths from the State master statistical data files were analyzed for 1999-2006, covering the period from when California began coding causes of death using ICD-10 codes through the most recent data currently available. The fetal death records include gestational age and weight at death. The infant death records do not include gestational age at birth or birth weight. These data are not included in the death registration process from which our infant death data come. Fetal deaths less than 20 weeks of gestational age are excluded from the analysis.

Table 1 shows the total and per-year average number of SF resident fetal and infant deaths that occurred over these 8 years. These data include deaths to SF residents that occurred out-of-county and have been reallocated to SF by the State Office of Vital Statistics.

Table 1. San Francisco Resident Fetal and Infant Deaths, 1999-2006

	Total deaths	Average deaths per year
Fetal deaths	330	41.2
Infant deaths	250	31.2

Source: California Fetal Death Statistical Master Files, 1999-2006,
California Death Statistical Master Files, 1999-2006

DEATHS BY YEAR AND SEX

Table 2 shows the distribution of deaths by type and sex over the eight years. There are more fetal than infant deaths (fetal deaths are 328 of 578 cases, 57%), and slightly more than half of fetal and infant deaths were males (males are 312 of 578 cases, 54%).

Table 2. Fetal and Infant Deaths by Type, Sex and Year, SF 1999-2006

Year	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL*
<u>Fetal deaths</u>	34	57	35	55	39	32	48	28	328
Male	23	30	19	29	18	24	20	14	177
Female	11	27	16	26	21	8	28	14	151
<u>Infant deaths</u>	31	35	31	38	27	31	30	27	250
Male	20	21	17	20	13	15	15	14	135
Female	11	14	14	18	14	16	15	13	115
<u>TOTAL DEATHS*</u>	65	92	66	93	66	63	78	55	578

Source: California Death Statistical Master Files, 1999-2006,
California Fetal Death Statistical Master Files, 1999-2006

* Total in this table omits 2 cases with unreported sex

These observations are based on small numbers. This report on fetal and infant mortality in San Francisco is seriously limited due to the small numbers involved. Therefore, unless otherwise noted, here and throughout, observations and interpretation of population differences should be taken as suggestive only. We plan to explore whether these local observations reflect underlying patterns of fetal and infant mortality using regional linked birth-death cohort data for this period. The regional linked birth-death cohort data allow for a more complete examination of fetal and infant mortality patterns. The numbers are larger, and include all fetal deaths, all births, and all births resulting in infant deaths. All birth-related information, including data that are available through the birth registration process, is available for infants who live as well as for those who have died in the first year of life.

ETHNICITY

Table 3 shows numbers of fetal and infant deaths by sex and ethnicity over 8 years.

Table 3. SF Resident Fetal and Infant Deaths by Sex and Ethnicity, 1999-2006.

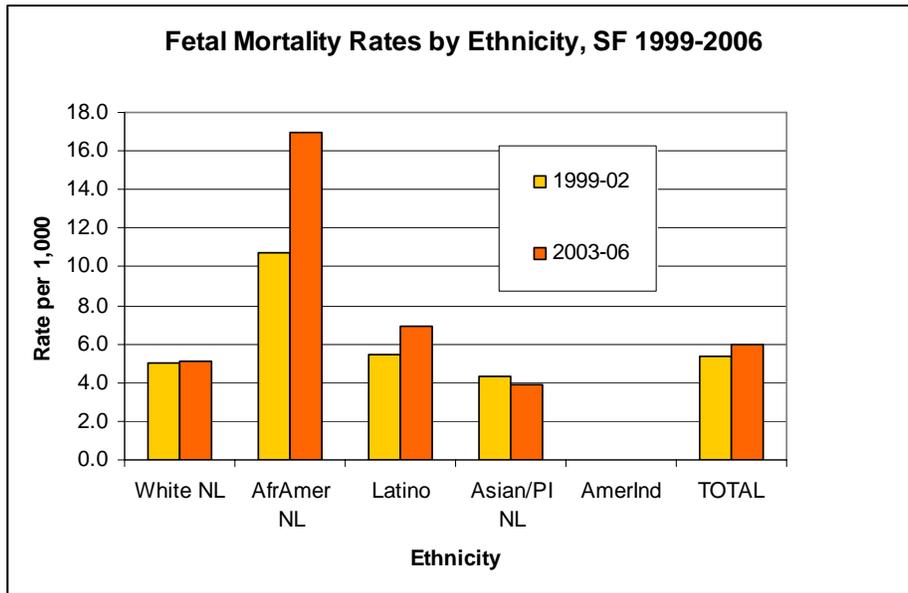
	Fetal Deaths			Infant Deaths			TOTAL DEATHS*
	Male	Female	All	Male	Female	All	
Latino	45	32	77	33	26	59	136
White NL	56	58	114	41	30	71	185
AA NL	36	22	58	32	27	59	117
Asian/PI	40	39	79	24	26	50	129
American Indian	0	0	0	1	0	1	1
Multi Ethnic	NA	NA	NA	4	6	10	10
TOTAL*	177	151	328*	135	115	250	578

Source: California Death Statistical Master Files, 1999-2006,
California Fetal Death Statistical Master Files, 1999-2006

* Total in this table omits 2 cases with unreported sex

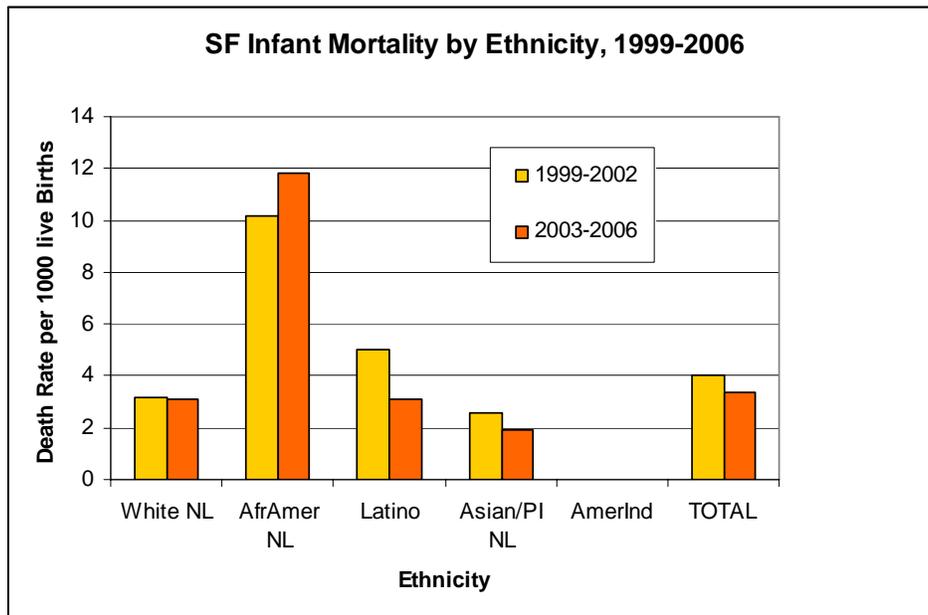
Table 4 shows fetal and infant deaths rates by ethnicity, aggregated over two four-year periods. African American infant mortality rates are higher than the rates for any other ethnic group for both time periods. For the period 1999-2002 the African American fetal and infant death rates are significantly higher than the rates for Whites and Asians. For 2003-06, African American fetal and infant death rates (16.9 fetal, 11.8 infant) are higher than that of all other ethnicities, as shown in Figures 1 and 2 and Table 4. There were no significant rate changes across the two time periods for infant deaths, but African American fetal deaths increased in the second time period.

Figure 1. SF Fetal Death Rates by Ethnicity, 1999-2002 and 2003-2006.



Sources: California Fetal Death Statistical Master Files, 1999-2006,
 FHOP County Birth Table
 Fetal death rates are per 1,000 live births and fetal deaths. NL= non-Latino

Figure 2. SF Infant Death Rates by Ethnicity, 1999-2002 and 2003-2006.



Sources: California Death Statistical Master Files, 1999-2006
 FHOP County Birth Table
 Infant death rates are per 1,000 live births. NL= non-Latino

Table 4. SF Resident Fetal and Infant Deaths and Death Rates by Ethnicity, 1999-2002 and 2003-2006.

	DEATHS		DEATH RATES*	
	1999-02	2003-06	1999-02	2003-06
<u>FETAL DEATHS</u>				
White NL	61	69	5.1	5.1
AfAm NL	32	42	10.7	16.9
Latino	40	50	5.4	6.9
Asian/PI	48	43	4.3	3.9
American Indian	0	0	--	--
TOTAL	181	204	5.4	5.9
<u>INFANT DEATHS</u>				
White NL	39	42	3.2	3.1
AfAm NL	30	29	10.2	11.8
Latino	37	22	5.0	3.1
Asian/PI	29	21	2.6	1.9
American Indian	0	1	--	--
TOTAL	135	115	4.1	3.4

Sources: California Death Statistical Master Files, 1999-2006,
 California Fetal Death Statistical Master Files, 1999-2006
 FHOP County Birth Table

* Fetal death rates are per 1,000 live births and fetal deaths.

Infant death rates are per 1,000 live births.

NL = Non-Latino

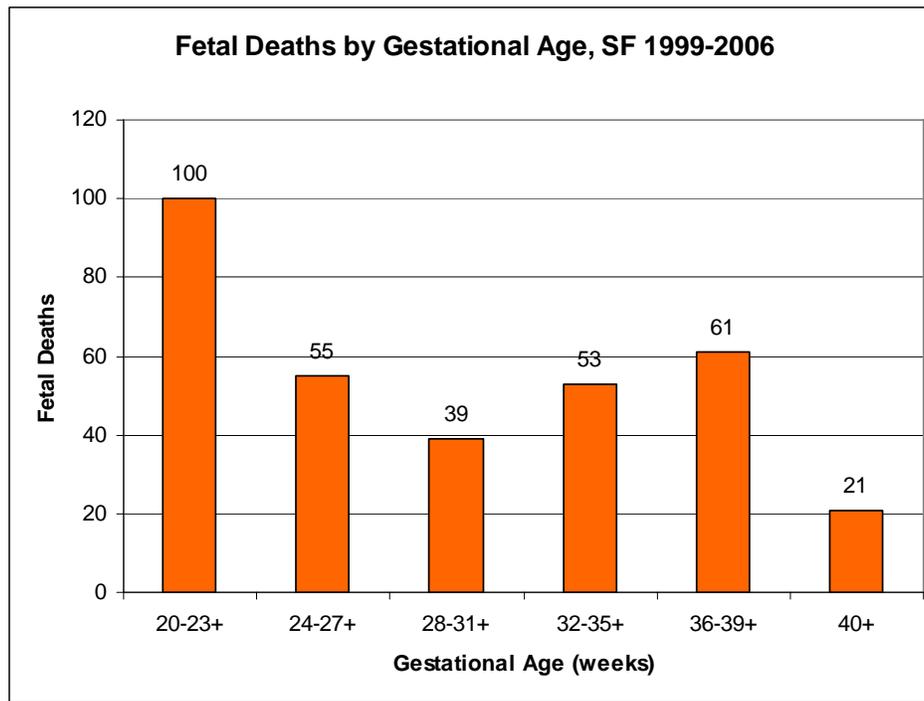
AfAm = African American

AGE AT DEATH

FETAL DEATHS

Figure 3 shows data on fetal deaths by gestational age. Fetal deaths decline with increasing gestational age to 31+ weeks, with losses before 24 weeks being much higher than in any other 4-week gestational age period. After increasing somewhat over weeks 32-39, fetal deaths drop substantially from 40 weeks on.

Figure 3. SF Fetal Deaths by Gestational Age, 1999-2006



Source: California Fetal Death Statistical Master Files, 1999-2006

Table 5. SF Fetal Deaths by Gestational Age and Sex, 1999-2006.

Gestational age (weeks)	20-23+	24-27+	28-31+	32-35+	36-39+	40+	TOTAL
Female	47	27	16	21	30	10	151
Male	52	29	23	31	31	11	177
TOTAL*	99	56	39	52	61	21	328

Source: California Fetal Death Statistical Master Files, 1999-2006

*Total in this table omits 2 cases with unreported sex

There were 177 male and 151 female fetal deaths, for an overall male to female fetal death ratio of 1.17:1.

INFANT DEATHS

These infant death data come from the death records registry, which does not contain information on gestational age at birth. We will use the linked birth-death cohort data (which includes gestational age for both fetal deaths and infant births and deaths) this year to examine infant mortality by gestational age more completely for SF and the Bay Area Region.

Figure 4 shows the distribution of infant deaths by age at death, also shown in Table 6 in more detail and broken out by sex. A very large burden of infant mortality occurs very soon after birth. Of the 250 total infant deaths, half occurred in the first week, including 98 (40%) that occurred in the first 24 hours. Deaths of 44 of these infants occurred within an hour of birth. Two-thirds of all infant deaths were neonatal deaths, occurring within the first 28 days of life.

Figure 4. SF Infant Deaths by Age at Death, 1999-2006.



Source: California Death Statistical Master Files, 1999-2006

Many of these earliest deaths occur to very premature infants (25% are due to prematurity or low birth weight; see Tables 11 and 12). We will examine in much greater detail the relationship of gestational age to mortality and to age at infant death from regional analysis of the birth-death cohort files.

The overall male-female ratio of infant deaths is 135:115, or 1.17:1, which is the same as the male to female ratio for fetal deaths (Table 6).

Table 6. SF Infant Deaths by Age at Death and Sex, 1999-2006.

Age at death	< 1 day	1-6 day	7-27 day	1 mo	2 mo	3 mo	4 mo	5 mo	6 mo	7 mo	8 mo	9 mo	10 mo	11 mo	TOTAL
Females	40	17	17	12	4	6	6	5	1	3	1	0	1	2	115
Males	58	13	22	16	11	3	3	3	2	2	0	0	1	1	135
TOTAL	98	30	39	28	15	9	9	8	3	5	1	0	2	3	250

Source: California Death Statistical Master Files, 1999-2006

CAUSES OF DEATH

Underlying causes of death are coded on the State master statistical files for deaths and fetal deaths based on the listings of immediate cause and contributing causes of death on the fetal and infant death certificates.

For ease of reporting we grouped individual causes of death into general categories based on National Center for Health Statistics (NCHS) infant death categories and the distribution of causes in SF. The causes of fetal and infant deaths are different, so they are presented separately.

FETAL DEATHS

Fetal death files list only the ICD-10 code for underlying cause. All of the fetal deaths were coded under two infant cause of death letter groups, P (“certain conditions arising in the perinatal period;” ICD-10 numbers P00-P96) and Q (“congenital malformations, deformations, and chromosomal abnormalities;” ICD-10 codes Q00-Q99). The most common single code, P95, “fetal death of unspecified cause” (“stillborn fetus not otherwise specified, stillbirth not otherwise specified”), is classified under Table 7 grouping “other perinatal conditions”.

Table 7. Causes of Fetal Death by Gestational Age at Death, SF 1999-2006

Gestational Age (in weeks)	20-23+	24-27+	28-31+	32-35+	36-39+	40+	TOTAL	% TOTAL
<u>P: Certain conditions arising in perinatal period</u>								
Other perinatal conditions	23	29	23	34	33	13	155	47%
Placenta/cord abnorm.	17	11	9	15	21	4	77	23%
Preterm/LBW.	26	5	0	0	0	0	31	9%
Pregnancy complications	22	3	1	0	0	0	26	8%
Other categories	2	3	5	2	4	1	17	5%
<u>Q: Congenital abnormalities</u>	10	4	1	2	3	3	23	7%
TOTAL*	100	55	39	53	61	21	329	100%

Source: California Death Statistical Master Files, 1999-2006

*One case omitted due to missing cause

Table 7 illustrates that the most common cause of death groupings, “other perinatal conditions” (47% of fetal deaths) and “placenta/cord” (23% of fetal deaths), occurred throughout the gestational age range. The third and fourth most common causes of fetal death groupings, “preterm/LBW” (9 % of fetal deaths) and “pregnancy complications” (8%), occurred before 28 weeks, with 48 of the 57 cases (84%) between 20 and 23 weeks. Other causes of fetal deaths were “congenital abnormalities” (7% of cases), with “maternal factors,” “cardiac dysrhythmia,” “hemorrhage” and “hypoxia” combined accounting for 5%.

INFANT DEATHS

The death master file for infants includes both the ICD-10 code and a more aggregated category of “infant cause of death” groupings. The actual distribution of ICD-10 codes is listed in an appendix to this report. We further aggregated the “infant cause of death” groups based on our distribution of causes. The distribution of these groupings by age at death is shown in Table 8.

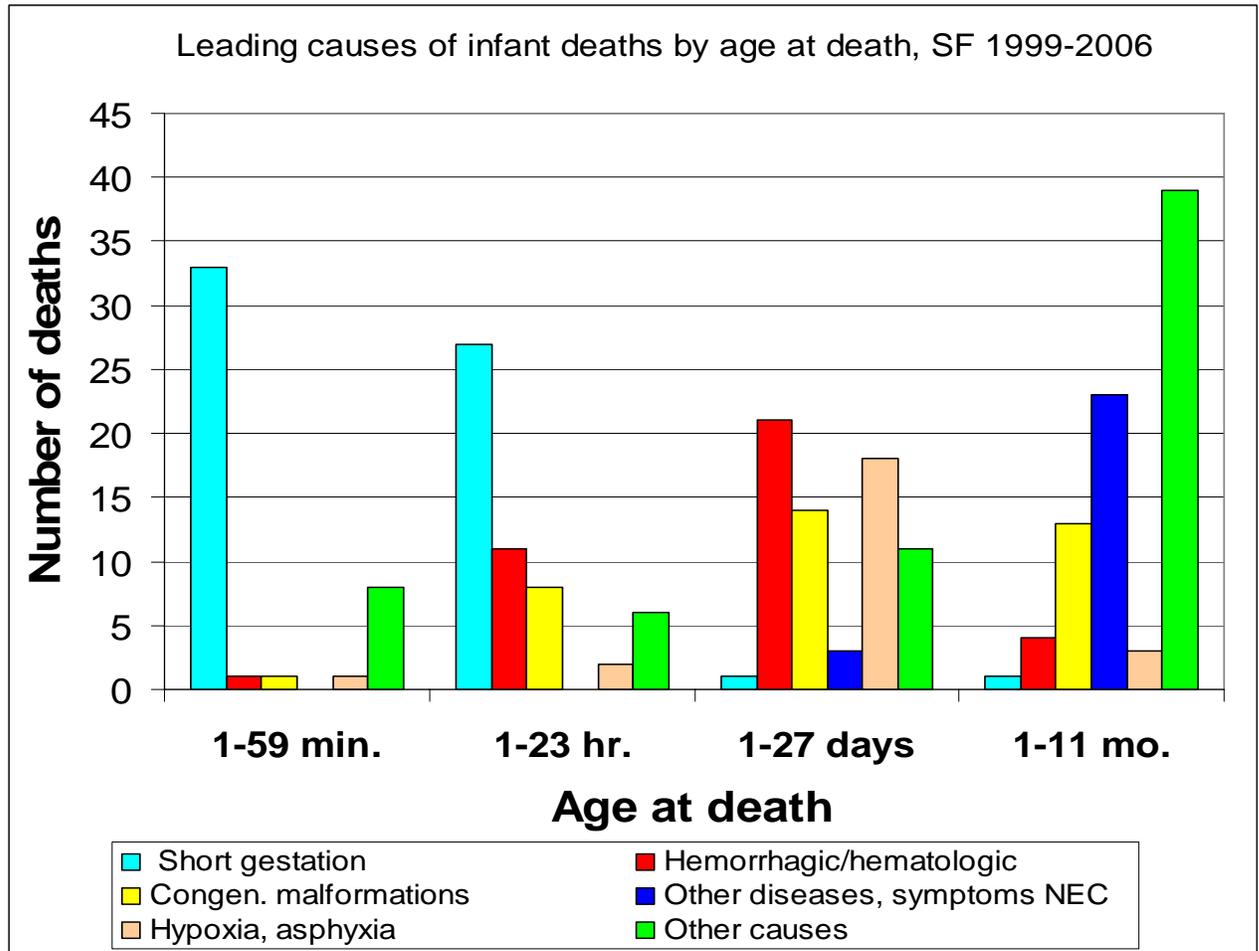
Table 8. Major Infant Causes of Death Groupings by Age of Death, SF, 1999-2006

Cause of death grouping	Age at death				TOTAL	% of TOTAL
	1-59 min.	1-23 hr.	1-27 days	1-11 mo.		
Short gestation-- LBW or prematurity	33	27	1	1	62	25%
Hemorrhagic/hematologic dis. of NB	1	11	21	4	37	15%
Congen. malformations, chromosomal abnormalities	1	8	14	13	36	14%
Other diseases, symptoms and signs NEC (primarily SIDS)	0	0	3	23	26	10%
Hypoxia, asphyxia, other respiratory	1	2	18	3	24	10%
All other categories	8	6	12	39	65	26%
TOTAL	44	54	69	83	250	100%

Source: California Death Statistical Master Files, 1999-2006

The five largest causes of death groupings (Table 8) together comprise three-fourths of all infant deaths. The distribution of age at death for these cause groups is shown graphically in Figure 5. Almost all of the deaths due to low birth weight or prematurity occurred within the first day of life. Most of the deaths due to “hemorrhagic/hematologic” and “hypoxia/asphyxia” causes occurred after the first hour but within the first month. The “other disease, symptoms not elsewhere classified (NEC)” category is primarily code R95, SIDS (25 of the 26 cases), which occurred mainly in infants older than one month.

Figure 5. Main Causes of Infant Death by Age at Death, SF 1999-2006.



Source: California Death Statistical Master Files, 1999-2006

CAUSE OF DEATH BY SEX AND ETHNICITY

The numbers of cases categorized by sex and ethnicity are small and are presented descriptively only. These results may be suggestive for further exploration in fetal and infant case reviews and by analysis of regional birth cohort data.

Table 9 below shows the distribution of fetal deaths by sex and cause. As noted, the overall sex ratio is 1.17:1 for male to female (177:151; see Table 5) fetal deaths. Table 10 below shows the distribution of fetal deaths by ethnicity and cause.

FETAL DEATHS

Table 9. Cause Groupings on Fetal Deaths by Sex, SF 1999-2006

Cause of death groupings	Female	Male	TOTAL
<u>P: Certain conditions arising in perinatal period</u>			
Other perinatal conditions	72	82	154
Placenta/cord abnormalities	34	43	77
Preterm/LBW	12	19	31
Pregnancy complications	12	14	26
Other categories	9	8	17
<u>Q: Congenital abnormalities</u>	12	10	22
TOTAL*	151	176	327

Source: California Fetal Death Statistical Master Files, 1999-2006

*3 cases omitted due to missing either sex or cause

Table 10. Cause Groupings of Fetal Deaths by Ethnicity, SF 1999-2006.

Cause of death groupings	Latino	White NL	AfAm NL	Asian/PI	Amer Ind	TOTAL
<u>P: Certain conditions arising in perinatal period</u>						
Other perinatal conditions	29	55	28	43		155
Placenta/cord abnormalities	27	29	10	11		77
Preterm/LBW	7	9	6	9		31
Pregnancy complications	6	8	4	8		26
Other categories	4	4	8	1	0	17
<u>Q: Congenital abnormalities</u>	5	8	3	7	0	23
TOTAL*	78	113	59	79	0	329

Source: California Fetal Death Statistical Master Files, years 1999-2006

* One case omitted due to missing cause.

NL=non-Latino

INFANT DEATHS

The main groupings of cause of infant death by sex are shown in Table 11. A more detailed table of ICD-10 underlying cause of death by sex for infant deaths is available in the appendix of this report.

Table 11. Cause Groupings of Infant Deaths by Sex, SF 1999-2006.

Cause of death grouping	Female	Male	TOTAL
Short gestation-- LBW or prematurity	22	40	62
Hemorrhagic/hematologic dis. of NB	17	20	37
Congen. malformations, chromosomal abnormalities	17	19	36
Other diseases, symptoms and signs NEC (primarily SIDS)	13	13	26
Hypoxia, asphyxia, other respiratory	10	14	24
All other categories	36	29	65
TOTAL	115	135	250

Source: California Death Statistical Master Files, 1999-2006

Infant cause of death groupings by ethnicity are shown in Table 12. Based on these small numbers there are not apparent differences in the distribution of major causes of death by ethnicity in SF (Table 12).

Table 12. Cause Groupings of Infant Deaths by Ethnicity, SF 1999-2006.

Cause of death grouping	White NL	Latino	AfAm NL	Asian/ PI	Amer Ind	Multi-eth	TOTAL
Short gestation-- LBW or prematurity	18	18	13	11	0	2	62
Hemorrhagic/hematologic dis. of NB	10	6	9	6	1	5	37
Congen. malformations, chromosomal abnormalities	10	11	8	7	0	0	36
Other diseases, symptoms and signs NEC (primarily SIDS)	6	5	7	7	0	1	26
Hypoxia, asphyxia, other respiratory	8	3	7	4	0	2	24
All other categories	19	16	15	15	0	0	65
TOTAL	71	59	59	50	1	10	250

Source: California Death Statistical Master Files, 1999-2006

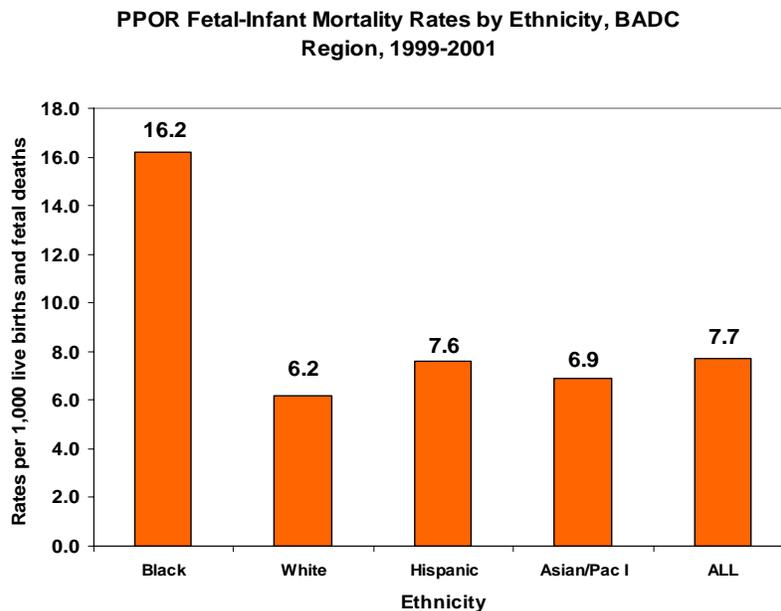
LINKED BIRTH-DEATH COHORT: REGIONAL PPOR ANALYSIS, 1999-2001

In the linked birth-death cohort compiled by the state, deaths to infants in the calendar year birth cohort are identified and their death records are linked to their birth records. Fetal death records for the year are also included in the cohort. The result is a birth and fetal death cohort with infant death data included in the dataset.

San Francisco was a founder of the nine county MCAH Bay Area Data Collaborative (BADC) in 2004. The BADC includes Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano and Sonoma counties. It was organized to promote regional MCAH coordination and cooperation. A primary goal of the BADC is to work collaboratively using regional data to bring greater statistical power to analytic studies. A major BADC project on ethnic disparities in fetal and infant mortality used the perinatal periods of risk (PPOR) analysis model on regional data from the State linked birth-death cohort files for 1999-2001. These data included 2,210 fetal and infant deaths linked to 287,044 births. PPOR analysis excludes fetal and infant deaths weighing less than 500 gms and fetal deaths at less than 24 weeks of gestation due to the demonstrated unreliability of these data. Regional fetal-infant mortality rates by ethnicity from that analysis are shown in Figure 3.

The PPOR model applied to regional 1999-2001 data reliably demonstrated major ethnic disparities in mortality, with Black FIM rate more than twice as high as that of any other ethnic group. County fetal and infant mortality results were similar to the regional results shown. In the coming year, BADC plans to update and expand this analysis through 2005, the most recent year for which linked birth-death cohort data are available.

Figure 6.



Source: PPOR Analysis of Regional CA Birth Cohort

SFDPH MCAH DATABASE: FETAL AND INFANT DEATHS, 2005-2007

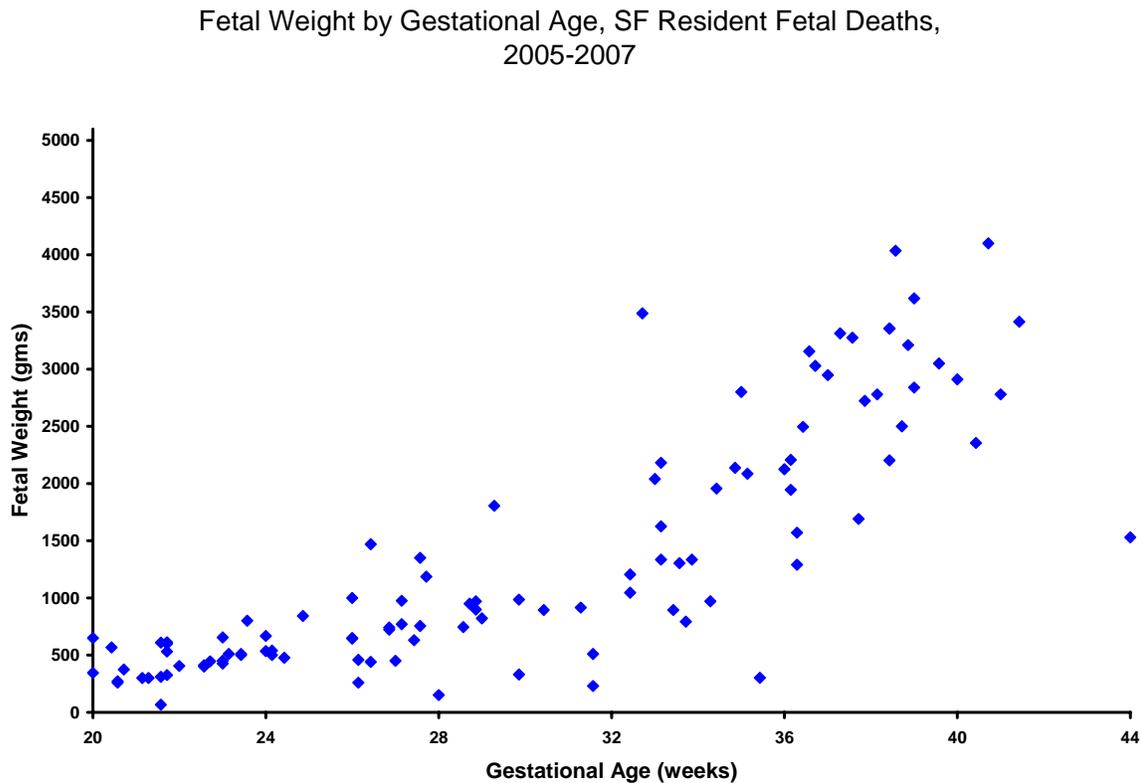
Since 2005 SFDPH MCAH has developed its own database of fetal and infant deaths that occurred in SF to SF residents. This database was developed originally for identification of cases for the case review teams. Case information for fetal deaths comes from fetal death certificates (hard copies) and includes several fields from those forms. Infant deaths were identified from death certificates for 2005 and 2006; since 2007 they have been identified from the EDRS death registration file. Birth information from AVSS records has been added to the cases in the database to facilitate their identification by physician reviewers in the hospitals.

This database has been used within the review process to record the clinical review outcomes. It has thus become a source of analysis in itself. We have expanded its fields in 2007 and will be expanding it further in the coming year. Since we first added gestational age at birth for infant deaths to this file in 2007, it is the only year for which we can present analysis of gestational age at birth for infant deaths from these data.

CHARACTERISTICS OF CASES, 2005-2007

For fetal deaths, Figure 7 below plots the relationship between fetal weight and gestational age, with losses concentrated before 32 weeks having very low fetal weights. Analysis of 107 fetal deaths from 2005 to 2007 shows what seems to be a log-linear increase in fetal weight as gestational age increases to 40+ weeks. There is a cluster between 20 to 23 weeks of fetuses weighing less than 500 grams. These very low weight cases are omitted from PPOR analyses due to the unreliability of their reporting.

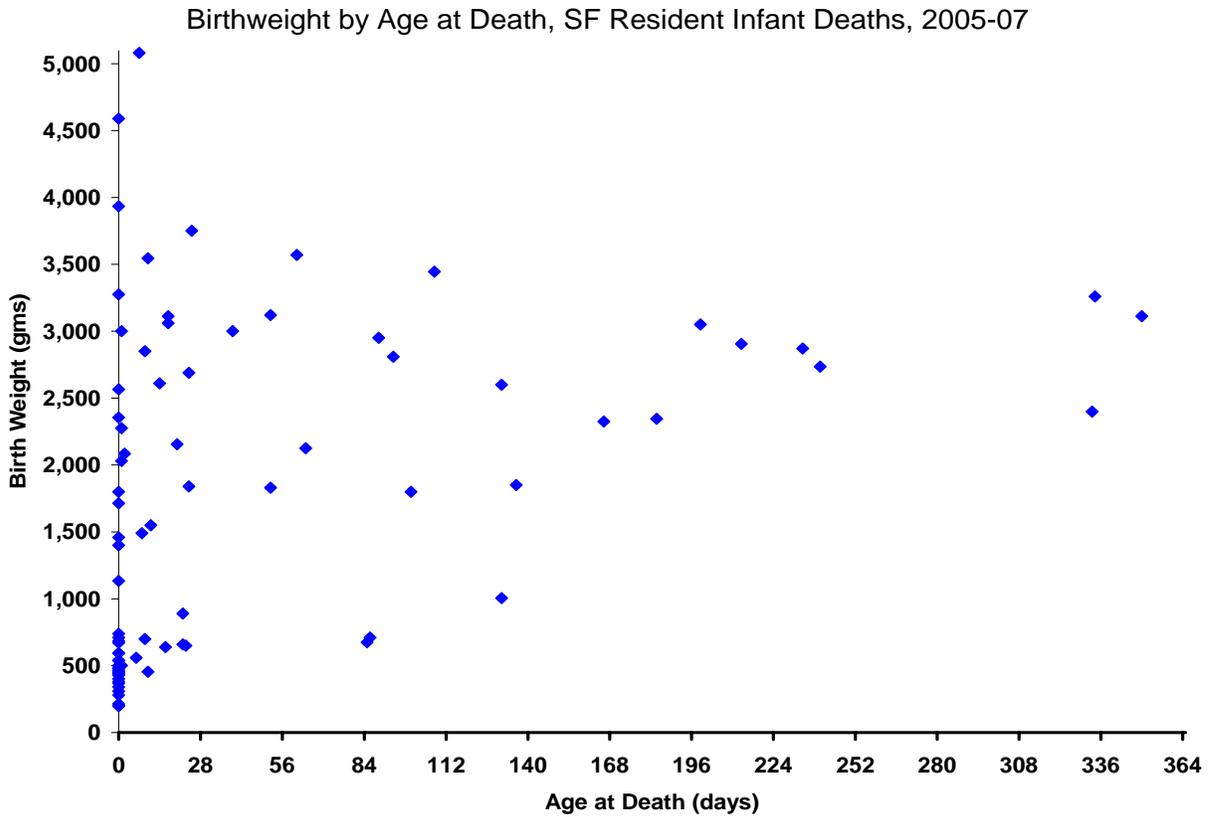
Figure 7.



Source: SFDPH MCAH Clinical Fetal and Infant Death Database, 2005-2007

Figure 8 below demonstrates the relationship of birth weight to age at death for 85 infant deaths from 2005 to 2007. These data demonstrate the large number of infant deaths of low birth weight in the first day. Most very low birth weight infants (<1500 gms) died within the first 28 days, and particularly during the first day of life (on the y axis line).

Figure 8.

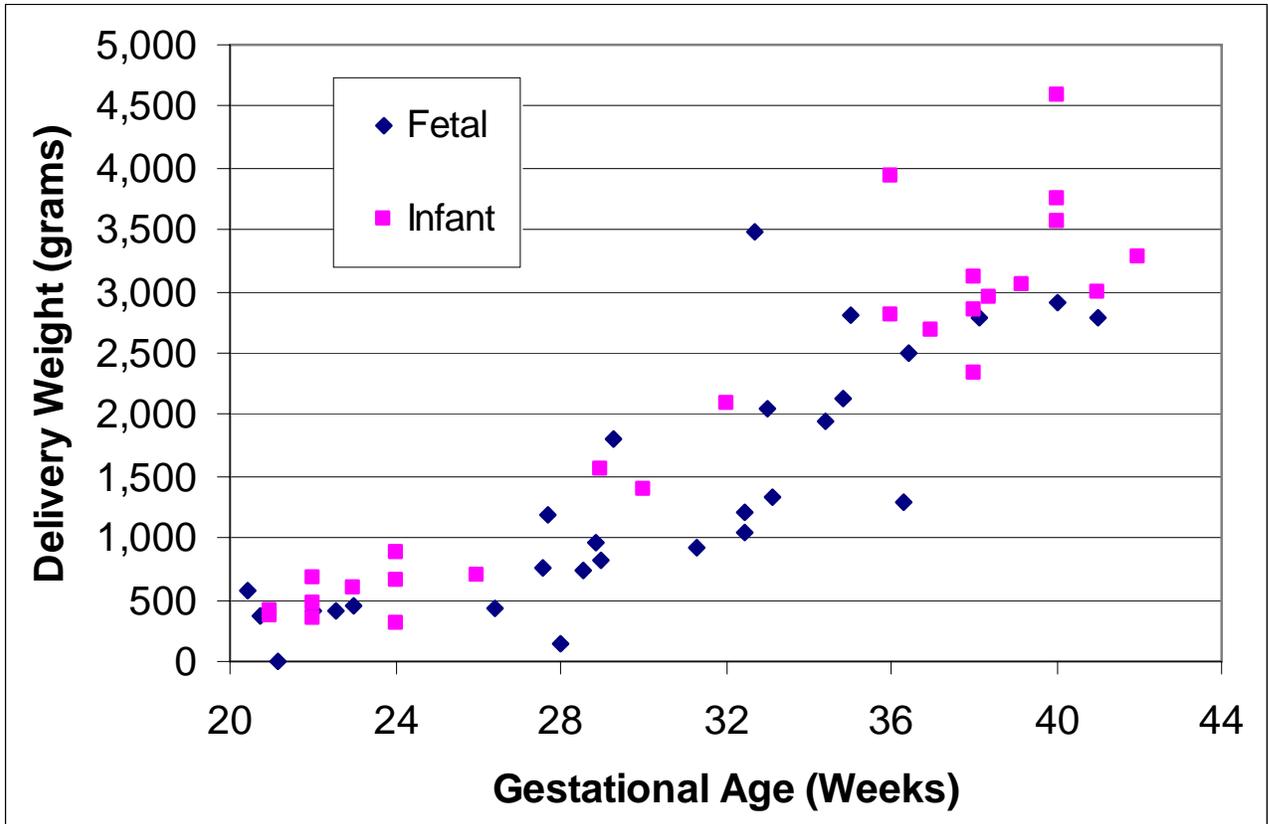


Source: SFDPH MCAH Clinical Fetal and Infant Death Database, 2005-2007

2007 CASES

For 2007 infant deaths we recorded gestational age at birth from the AVSS birth records in our database. Considering the relationship between gestational age and weight, fetal deaths are most concentrated below approximately 34 weeks, with low weight.

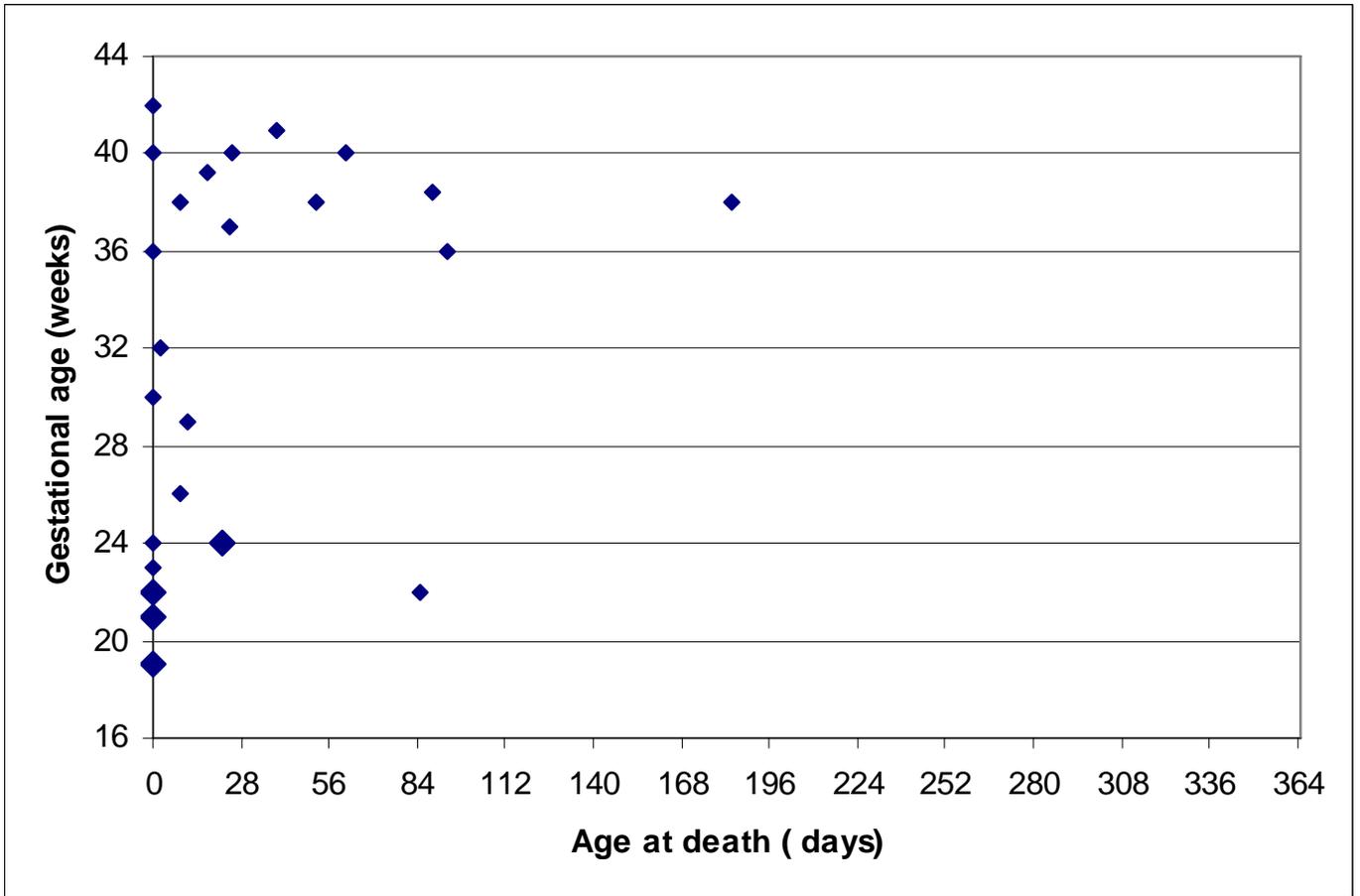
Figure 9. Delivery Weight by Gestational Age, SF Fetal and Infant Deaths, 2007



Source: SFDPH MCAH Clinical Fetal and Infant Death Database, 2005-2007

Gestational age data was available for 28 of the 33 infant death cases in 2007. Almost half (13) died in the first day of life, including 8 infants with gestational ages of 24 weeks or less. Of the 15 infant deaths with gestational ages of 32 weeks or less, all but one died in the neonatal period. (Figure 10). Infants with gestational ages of at least 36 weeks died relatively uniformly across the first 3 months of life. Only one of the 33 infant deaths occurred after the 94th day.

Figure 10. Gestational Age at Birth by Age at Death, SF Resident Infant Deaths, 2007



Source: SFDPH MCAH Clinical Fetal and Infant Death Database, 2005-2007

◆ = 2 Cases

FETAL AND INFANT DEATH REVIEW PROCESS SINCE 2005

DEVELOPMENT OF REVIEW COMMITTEES

CHILD DEATH REVIEW (CDR) COMMITTEE

The San Francisco Child Death Review (CDR) Team has operated continuously out of the Medical Examiner's office since 1988. This interagency team reviews infant and child death cases, to age 18, that are reported to the Medical Examiner. The SFDPH MCAH Division is represented by its medical director and FIMR coordinator at the CDR team's regular bimonthly meetings.

The CDR team reviews only cases reported to the Medical Examiner's Office, which are deaths unattended by a physician, and all deaths in which there is some reason to believe that the death is not due to a natural disease process. Because of the emphasis on forensic aspects of children's deaths, the CDR team reviews only a small portion of the fetal and infant death cases occurring in San Francisco.

FIMR REVIEW

Between 1998 and 2005, cuts in funding resulted in the loss of a full-time FIMR coordinator in San Francisco. Fetal and infant death reviews were not regularly or systematically performed, and the FIMR team's membership and processes became diminished. Much of the review team energy was directed toward determining medical causes of death.

When MCAH renewed its efforts to develop systematic fetal and infant death reviews in 2005, it decided to develop new approaches to membership and process. It was decided to put together, on the one hand, a team with medical and public health expertise to provide a medical review of the cases, and on the other, a team of community reviewers to address the contribution of social, community and other non-medical systematic issues that might have contributed to these deaths. The team developed to address medical and other health related causes of fetal and infant death since 2005 consists of two specialist panels of physicians and public health professionals, the Women's Health Advisory Board (WHAB) and the Neonatology Advisory Board (NAB).

WHAB AND NAB

The Women's Health Advisory Board is a collaborative advisory body on women's health care practice and policy, consisting of the chiefs of obstetrics and gynecology and their representatives from the San Francisco hospitals providing women's health and maternity care and MCAH public health professionals. These hospitals include: University of California at SF, Mt. Zion Hospital, San Francisco General Hospital, Kaiser Permanente SF, California Pacific Medical Center, and St. Luke's Hospital. The WHAB was created to provide expert advice on women's health care practice and perinatal outcomes improvement for the Maternal, Child and Adolescent Health Section of San Francisco County.

The Neonatal Advisory Board is a collaborative advisory body on neonatal health care practice and policy, consisting of the chiefs of pediatric neonatology and their representatives from the San Francisco hospitals providing neonatal intensive care units (University of California at SF, San Francisco General Hospital, Kaiser Permanente SF, California Pacific Medical Center, and St. Luke's Hospital), and MCAH public health professionals. The NAB is particularly interested in developing advice and policy direction that is relevant to the development and maintenance of quality assurance and improvement in neonatal and pediatric practice as it affects the entire population of San Francisco County.

The WHAB, first formed in fiscal year 2005-06, was convened to address the marked disparity in perinatal health outcomes between racial/ethnic subgroups in San Francisco County. It adopted as its first task the creation of a county-wide, pan-hospital, universally applicable, physician-supported collaborative fetal and infant mortality review system for all of the county's fetal and infant deaths, regardless of hospital birth place or death place. The WHAB designed and developed a county-wide perinatal data abstraction and reporting form in fiscal year 2006-07. That year, of the 79 identified fetal and infant deaths from calendar year 2005, they reviewed 64 cases of fetal deaths and very early neonatal deaths up to one day of life before death.

By the end of FY 2006-2007, the WHAB felt that expert advice in neonatal pediatrics was needed to review the infant deaths that occurred after one day of age and up to one year of age. At that time, the Neonatal Advisory Board was recruited from the same hospitals in the county. The NAB agreed to review all of the deaths of infants from one day to one year of age, as well as any very early neonatal deaths (under 1 day of age) if requested by the WHAB. Each Board agreed to review any cases of the other Board if requested to do so. In 2008 NAB developed a county-wide infant death data abstraction and reporting form, modified from the WHAB form for pediatric use. This is presently being developed as a web-based electronic report form and database. The SF County DPH IT Department is programming this electronic report form/database for availability to MCAH and the reviewing physicians as a secure, password accessible site on the County DPH secure server.

In FY2007-2008, both the WHAB and the NAB undertook to review as many 2007 fetal and infant death cases as concurrently as possible in order to determine the immediate, contributing, and underlying causes of death. This project has two goals:

- (1) The medical cause of death can be provided to the Community Review Team (CRT) carrying out the Fetal and Infant Mortality Reviews as mandated for the State MCAH. The WHAB and NAB believe that providing this information to the CRT will relieve the CRT from the burden of attempting to ascertain medical cause of death during their deliberations, thereby supporting their goal of determining social, environmental, and community risk factors which can be addressed; and
- (2) The immediate and contributory causes of death determined by the WHAB and NAB are recorded, and the underlying causes are determined. These can be compared to those causes recorded on the death certificates locally and the underlying causes of death can be compared with those underlying causes coded by the State for quality improvement and assurance purposes. Causes can also be reviewed to determine if any underlying patterns are identifiable.

COMMUNITY REVIEW TEAM (CRT)

Early in 2008, SF was able to appoint a full-time FIMR coordinator. Under her leadership, the Community Review Team reviewed 19 fetal and infant deaths that occurred in 2007. In addition, WHAB or NAB, or both, medically reviewed 10 of these CRT cases. The CRT has also reviewed 9 additional cases not yet reviewed by WHAB or NAB.

CASES REVIEWED, 2007

As noted, after the WHAB reviewed 64 of the 79 cases of fetal and infant deaths in 2006-2007, it was decided to (1) add NAB reviews to cover infant deaths past the first day of life, and (2) to move forward to reviewing 2007 cases to develop a more concurrent review process.

For 2007 we identified 28 fetal and 33 infant deaths; a total of 61 cases. Forty-three of the 61 cases (70%) received at least one form of review, including three-quarters (21/28) of fetal deaths and two-thirds (22/33) of infant deaths. Thirty-four cases have thus far been reviewed by our medical review teams, WHAB or NAB. Nineteen cases were reviewed by CRT. Ten cases were reviewed both medically (by WHAB or NAB) and by the CRT.

Eighteen cases received neither kind of review. Of these, two were cases reviewed by the medical examiner's Child Death Review (CDR) team. Since CDR includes review of causes of death by physicians (including forensic review by the medical examiner), these cases were explicitly deleted from those we asked WHAB or NAB to review.

Details of cases reviewed are shown in Table 13 below.

Table 13. Characteristics and Review Status of SF 2007 SF Fetal and Infant Mortality Cases

	TOTAL*	Asian/PI	AfAm	Latino	White
Total Fetal Deaths	28	8	4	7	9
Reviews Completed:	21	5	3	6	7
WHAB	14	3	2	4	5
CRT	14	3	3	5	3
Percent reviewed	75%	63%	75%	86%	78%
Total Infant Deaths	33*	12	5	7	8
Reviews Completed:	22	8	4	5	5
WHAB	9	4	1	3	1
NAB	14	5	2	2	5
CRT	5	0	3	2	0
Percent reviewed	67%	67%	80%	71%	63%
Total Fetal & Infant Deaths	61	20	9	14	17
Reviews Completed:	43	13	7	11	12
Medical	34	11	5	8	10
CRT	19	3	6	7	3
Percent reviewed	70%	65%	78%	79%	71%

*One infant death included in the total was not categorized into any of these 4 ethnicities.

CONCLUSION

The review process we have developed since 2005 has been useful both for understanding factors affecting individual cases and for bringing together medical and public health expertise to investigate both population and environmental causes of fetal and infant mortality in SF. Our mortality numbers are too small to determine whether many of the factors of interest to us have an affect on the patterns of fetal and infant mortality for San Francisco. Given this, we plan to:

- Continue the medical and community case reviews
- Streamline case-finding and data abstraction for local reviews
- Integrate and optimize the sequence of the review components (medical and community reviews)
- Present aggregated case data to review teams for analysis and consideration on both epidemiological and quality assurance bases
- Continue to develop and expand the concurrent case database, incorporating more clinical information from vital records and the review process for increased productivity and analysis
- Cooperate with Bay Area MCAH programs to conduct a regional analysis of most recent linked birth-death cohort files, using large numbers of cases with more complete data to explore relationships suggested by local data, and to suggest epidemiologic patterns which may be considered in local review processes.

APPENDIX 1

COMPARISON OF DATA ANALYZED IN THIS REPORT

Type of Case		Fetal and infant deaths	PPOR analysis of Birth Cohort Data	MCAH Clinical Database
	<i>Years</i>	1999-2006	1999-2001	2005-2007
Fetal deaths	<i>Source</i>	CA master stat file	CA linked birth-death cohort	SF fetal death certificates
	<i>Records</i>	All resident deaths	All resident deaths	SF resident & occurrence deaths
	<i>Fields</i>	All	All	Selected
Infant deaths	<i>Source</i>	CA master stat file	CA linked birth-death cohort	SF death certificates; EDRS
	<i>Records</i>	All resident deaths	All resident deaths	SF resident & occurrence deaths
	<i>Fields</i>	All	All	Selected
Live births	<i>Source</i>	--	CA linked birth-death cohort	AVSS
	<i>Records</i>	none	All resident live births	Infant deaths only
	<i>Fields</i>	--	All	Selected

APPENDIX 2

UNDERLYING ICD-10 CAUSE OF DEATH CODES FOR INFANT DEATHS, SF 1999-2006

Infants' Underlying Causes of Death, ICD-10 Codes, by Sex

ICD-10 underlying cause of death codes are composed of a letter group prefix, followed by 2 or 3 numbers specifying the exact code. If there are 3 numerical digits, there is an implied decimal point between the 2d and 3d digits (e.g., A415 is ICD-10 code A41.5), with the 3d digit adding detail to the ANN (letter-digit-digit) cause code.

Major groupings are shown. Specific causes are named only for causes with 3 or more cases in these data.

ICD-10 codes can be found at:

<http://www.who.int/classifications/apps/icd/icd10online/>

<u>ICD10</u>	<u>M</u>	<u>F</u>	<u>Specific cause</u>	<u>ICD10</u>	<u>M</u>	<u>F</u>	<u>Specific cause</u>
<u>Certain infectious(A codes) or viral (A80, B codes) diseases</u>				J450	0	1	
A415	1	2	septicemia(gr-)	J90	0	1	
B009	0	1		J984	1	1	
B207	0	1		K550	1	2	vasc. dis.,intest.
B259	1	0		K559	1	0	
<u>Neoplasm (C, D codes)</u>				N19	1	0	
C64	1	0		CONDITIONS ARISING IN PERINATAL PERIOD (P00-P96)			
C959	0	1		<u>Maternal complications of pregnancy</u>			
D480	0	1		P010	1	2	incompetent cervix
D694	1	0		P011	1	4	premature rupture of membranes
D899	0	1		<u>Complications of placenta, cord, or membranes</u>			
<u>Diseases of the nervous system (G codes)</u>				P023	0	1	
G419	0	1		P025	0	1	
G709	2	1	myoneural disorder	P027	0	1	
G729	0	1		P039	1	0	
G809	0	1		<u>Length of gestation and fetal growth(P05-P08)</u>			
G931	0	1		<u>Short gestation and low birth weight</u>			
G934	1	0		P072	33	17	extreme prematurity
<u>Diseases of the circulatory system (I codes)</u>				P073	7	5	prematurity, not otherwise specified
I270	1	0		P119	0	1	
I429	1	0		<u>Hypoxia, asphyxia</u>			
I619	0	1					
I629	1	0					
<u>Diseases of the respiratory (J codes), digestive (K codes), or genito-urinary (N codes) systems</u>							
J209	0	1					

<u>ICD10</u>	<u>M</u>	<u>F</u>	<u>Specific cause</u>
P209	2	0	intrauterine hypoxia
P219	3	1	birth asphyxia
P220	2	2	resp. distress syndrome, newborn
<u>Other respiratory</u>			
P236	0	1	
P239	1	0	
P240	2	0	
P251	0	1	
P252	1	0	
P253	0	1	
P269	0	1	
P271	1	2	broncho-pulmonary dysplasia
P280	1	0	
P285	1	0	
P291	7	1	neonatal cardiac dysrhythmia
<u>Infections of perinatal period</u>			
P360	0	1	
P363	1	0	
P368	1	1	
P369	2	1	bacterial sepsis
P375	1	0	
<u>Hemorrhagic or hematological disorders of newborn (P50-P61)</u>			
P523	1	2	
P529	2	2	intracranial hemorrhage
P614	0	1	
P77	6	5	necrotizing enterocolitis
P780	1	0	
P783	0	1	
P832	1	1	hydrops
P910	0	1	
P960	0	2	
P968	1	1	
P969	1	0	
CONGENITAL MALFORMATIONS, CHROMOSOMAL ABNORMALITIES (Q codes)			
Q000	0	1	
Q019	0	1	
Q039	1	0	
Q042	0	1	

<u>ICD10</u>	<u>M</u>	<u>F</u>	<u>Specific cause</u>
Q043	0	1	
Q048	1	0	
Q049	1	0	
<u>Congenital malformations of the heart (Q20-Q24)</u>			
Q201	1	0	
Q212	0	1	
Q213	2	0	
Q230	0	1	
Q233	1	0	
Q234	3	1	hypo-plastic left heart syndrome
Q245	1	0	
Q255	1	0	
Q256	0	1	
Q268	0	1	
Q315	0	1	
Q349	1	0	
Q410	1	0	
Q419	1	1	
Q878	1	0	
Q897	0	2	
Q899	0	2	
Q909	2	0	
Q913	0	1	
Q917	1	0	
Q999	0	1	
<u>Symptoms, signs not elsewhere classified</u>			
R95	12	13	SIDS
R99	1	0	
EXTERNAL CAUSES (U01, V-Y)			
<u>Accidents</u>			
V031	1	0	
V476	1	0	
W75	3	2	accidental suffocation in bed
W83	0	1	
<u>Assaults</u>			
X95	1	0	
Y12	0	1	
Y20	0	1	
Y34	1	0	
<u>Complications of medical care (Y40-Y84)</u>			
(none)			

Source: California Death Statistical Master Files, years 1999-2006