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Findings of the

Alaska Maternal-Infant Mortality Review

1992-2001

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Background

During the late 1980s, Alaska's infant mortality rate (IMR) was 1.2 times greater than that of the United States overall. In response, the Alaska Section of Women's, Children's, and Family Health established the Maternal-Infant Mortality Review (MIMR) program to coordinate retroactive reviews by a panel of experts of the circumstances surrounding infant deaths and make recommendations for reducing Alaska's IMR. The MIMR committee is composed of family physicians, pediatricians, obstetricians, intensivists, neonatologists, perinatologists, nurse practitioners, and program managers, as well as representatives from the State Medical Examiner's Office and the Office of Children's Services. The committee began reviewing deaths in 1992 and reviewed 755 of the 759 (99.5%) known Alaskan resident infant deaths that occurred during January 1, 1992 through December 31, 2001. This report summarizes the committee's consensus findings on contributors to and causes of infant death.

Methods

The Maternal and Child Health Epidemiology Unit, in the Section of Women's, Children's and Family Health, of the Alaska Division of Public Health, attempts to acquire a standard set of information for each death of an Alaska resident infant that occurs in Alaska or in another state. Program staff collect information from infant and maternal medical records and from birth and death certificates for all infants and, where appropriate, autopsy and police reports, including death scene investigation records. The MIMR committee meets once each month to review data for each infant death, to identify the most likely underlying and contributing causes of death, and to determine whether the death was potentially preventable and what factors might have altered the outcome. Committee member decisions are initially recorded on a consensus form and later transferred to a computer database for management and analysis.

The consensus form asks the committee members to list the "most probable cause of death for the infant" as well as "other contributing cause(s) of death," and whether the "death certificate accurately reflects the above causes of death." If they select "no" for the latter, they indicate whether the death certificate "accurately reflects the contributing cause(s) of death but not the most probable cause," "accurately reflects the most probable cause of death but not the contributing cause(s)," or "does not accurately reflect either the contributing or most probable cause of death."

In this report, we use the committee consensus causes of death and allow for multiple causes. Therefore, cause-specific mortality rates may differ from those presented elsewhere based on death certificate cause of death. The Alaska Bureau of Vital Statistics provided birth certificate data on maternal demographic characteristics, gestation, and population denominators for rate calculations. For cause-specific calculations, we combined sudden infant death syndrome (SIDS) with asphyxia into a single category due to the potential for diagnostic shift between these designations.

IMRs in this report are presented as 3-year averages because of the small number of infant deaths during any given year in Alaska.

Results

Infant Mortality Rates

Alaska had an IMR in 1999-2001 of 6.6 per 1,000 live births, similar to the rate of 6.8 reported in 2001 for the United States. Alaska's 1999-2001 neonatal (age 0-27 days) mortality rate of 3.2 per 1,000 live births was less than the national rate of 4.5; however, the post-neonatal (age 28-364 days) mortality rate of 3.3 per 1,000 live births was 50% greater than the 2001 United States post-neonatal mortality rate of 2.3. Alaska's infant, neonatal, and post-neonatal mortality rates all remained above the Healthy Alaskans 2010 targets of 4.5, 2.5, and 2.3 per 1,000 live births, respectively. Alaska's infant mortality rate declined from 8.1 per 1,000 live births in 1992-1994 to 6.0 in 1998-2000, but increased to 6.6 in 1999-2001 (Figure 1). The rise during the last period was almost all due to an increase in post-neonatal, rather than neonatal mortality.

Neonatal and post-neonatal deaths have different maternal risk factors. During 1992-2001, post-neonatal mortality rates varied by over four-fold within subcategories based on maternal characteristics (Table 1). The highest reported rates occurred among mothers who were less educated, younger, and Alaska Native, and mothers residing in the Northern and Southwestern regions of Alaska. Neonatal mortality rates varied less but still differed by up to 80% within sub-populations.

Agreement with death certificate cause of death

The committee fully agreed with the death certificate cause of death for 334 of 755 (44%) cases. Allowing for multiple causes of death, agreement between the committee and death certificates was low within all evaluated cause of death categories. The committee considered that the death certificate cause of death was completely accurate for 100 of the 193 (52%) deaths for which the committee assigned congenital anomalies as a contributing cause. The accuracy was lower for deaths for which the committee assigned sub-optimal medical care (18 of 36; 50%), SIDS/asphyxia (89 of 217; 41%), preterm birth (89 of 215; 41%), perinatal causes (30 of 76; 36%), infections (39 of 110; 36%), and neglect or abuse (16 of 50; 32%) as a contributing cause of death.

Of the 421 death certificates that did not agree with the committee cause of death findings, the committee believed that: 146 (35%) accurately reflected the most probable cause of death but not the contributing cause(s); 78 (19%) accurately reflected the contributing cause(s) of death, but not the most probable cause; 158 (38%) did not accurately reflect either the most probable or contributing cause(s) of death; and 39 (9%) did not have this information specified. Of deaths classified as having death certificates that did not accurately reflect either the most probable or contributing cause(s) of death, the committee determined that preterm birth contributed to 48 (41%), SIDS/asphyxia to 39 (25%), congenital anomalies to 39 (25%), and infections to 27 (17%). All other causes each contributed to less than 12% of these deaths.

Leading cause of death categories

The three leading cause of death categories evaluated were SIDS/asphyxia, preterm birth, and congenital anomalies (Table 2). They remained the three leading causes of death among most sub-populations that were evaluated (Table 3). The only population for which SIDS/asphyxia was not one of the top three causes of infant death was infants born to mothers 35 years of age and older. Some evaluated causes of death primarily

affected infants during only the neonatal period, and some during only the post-neonatal period (Figure 2); 88% of deaths related to preterm birth occurred during the neonatal period, while 89% of SIDS/asphyxia deaths occurred during the post-neonatal period.

None of the contributing category-specific mortality rates changed significantly during 1992-2001 (Figure 3). The most sustained visible decrease was in mortality from SIDS/asphyxia, which declined 37% from 2.5 deaths per 1,000 live births in 1992-1994 to 1.6 in 1997-1999. However, mortality from SIDS/asphyxia then rose to 1.9 per 1,000 live births in 1999-2001. In contrast, the trend in the SIDS-only mortality rate as calculated using the death certificate cause of death continually declined during the years examined.

Preterm birth

The category of preterm birth as a contributor to infant mortality was based on the committee determination that a preterm delivery (<37 weeks gestation) was associated with the death. This category was not necessarily associated with all infants born preterm who later died. While mortality from preterm birth fell from 2.1 per 1,000 live births during 1992-94 to 1.7 during 1999-2001, for the same time periods, the proportion of all live births in Alaska that were delivered preterm increased from 6.8% to 8.6%.

Almost all of this increase was due to an increase in births between 32 and 36 weeks of gestation (preterm), rather than births prior to 32 weeks gestation (extremely preterm). During 1992-2001, term births had an IMR of 4.2 per 1,000 live births, compared to 14.9 for preterm and 196.6 for extremely preterm births.

The total IMR for infants born at less than 37 weeks gestation was 41.8 per 1,000 live births. Relative to infants born at term, those born preterm were more likely to die from all causes evaluated, with the strongest associations for perinatal causes (Rate Ratio [RR]: 18.1; 95% Confidence Interval [CI]: 11.3-28.9), infections (RR: 13.3; CI: 9.1-19.4), and sub-optimal medical care (RR: 13.3; CI: 6.9-25.6) (Figure 4).

Sub-optimal medical care

Sub-optimal medical care was considered to have contributed to death when the committee identified errors in medical interventions or lack of appropriate care. While sub-optimal medical care contributed to 36 (4.7%) infant deaths during 1992-2001, it was the sole identified cause in just one death. Additional contributing causes to these deaths included infections (13 deaths), congenital anomalies (15), preterm birth (14), and perinatal causes (4). Evaluated sub-populations had similar infant mortality rates from sub-optimal medical care (Table 4).

Neglect or abuse

We considered neglect or abuse to have contributed to death when the committee found evidence of possible or probable intentional injury in the case records. Without considering if the evidence met legal standards of proof, committee members noted types of neglect or abuse (including intentional trauma, possible suffocation, failure to thrive, and intentional maternal abdominal trauma) as a cause of death when this was the most likely etiology in their judgment. Thirty-seven of the 50 deaths associated with neglect or abuse had other non-injury related contributing causes, including SIDS/asphyxia (21 deaths), infections (7), preterm birth (3), and one each for perinatal issues and congenital anomalies. Neglect or abuse-associated

IMRs varied greatly by maternal characteristics, with less educated and younger mothers having the highest rates (Table 4).

Drug use

According to birth certificate data on maternal prenatal tobacco cigarette and alcohol use, infants of mothers who smoked or drank during pregnancy had a mortality rate of 12.7 per 1,000 live births, more than twice the 5.8 IMR for infants whose mothers did not smoke or drink. Maternal prenatal behavior reported on birth certificates should be interpreted carefully, however, as it may be influenced by self-reporting and screening biases that increase positive reporting among certain groups.

During case reviews, MIMR committee members indicated if they found evidence that substance use (including alcohol, tobacco, or other drugs) by any caretaker may have contributed to the infant's death. We used this information to create a variable for *drug-associated* deaths. A second variable for *drug-noted* deaths combined the committee findings of substance use with birth certificate information on prenatal smoking and alcohol consumption. Overall, 10% of deaths were drug-associated (IMR, 0.7 per 1,000 live births) and 41% were drug-noted (IMR, 3.0 per 1,000 live births). (By comparison, 22% of all live births in Alaska indicated maternal prenatal alcohol or tobacco use). Among categories of death, SIDS/asphyxia and neglect/abuse had the highest percentages of cases that were also drug-noted (58% for both) or drug-associated (22% and 20%, respectively) (Figure 5). Infants born to the least educated and Alaska Native women had the highest rates of drug-associated and drug-noted deaths (Table 5).

Alaska Native infant mortality

Compared to non-Natives, Alaska Natives had twice the total risk of infant mortality, as well as higher cause-specific infant mortality rates for all categories of death evaluated except sub-optimal medical care and perinatal issues (Table 6). The disparity between Alaska Native and non-Native IMRs was greatest for SIDS/asphyxia and infections. Among Alaska Natives, the post-neonatal was higher than the neonatal mortality rate, while the opposite was true for non-Natives.

We compared infant mortality rates for Alaska Natives and non-Natives across maternal risk factor categories, and found that Alaska Natives had significantly higher IMRs within almost all examined strata (Table 7).

Discussion

Although the IMR in Alaska decreased by 50% over the study period, it increased slightly during the last 3 years of the study period and remains 50% higher than the Healthy Alaskans 2010 goal. Similarly, post-neonatal, neonatal, and cause-specific mortality rates did not improve substantially during the latter half of the study period. The increase in Alaska's IMR at the end of the study period is similar to a recent trend in the United States infant mortality rate, which rose from 6.8 per 1,000 live births in 2001 to 7.0 in 2002, the first annual increase in the national IMR since 1958.[1] In contrast to Alaska findings, however, the national increase was primarily among neonatal deaths.

The review process implemented through the MIMR may more accurately identify preventable factors impacting infant mortality than analysis of vital statistics data alone.[2] The MIMR committee's frequent

disagreement with the death certificate for all major causes of death reflects this potential. However, obstacles to obtaining complete and consistent information for each case can limit the quality of the data the process provides. Most infant mortality review teams nationwide use hospital medical records, birth or death certificates, medical examiner's records or death site reports, and maternal or parent interviews as key data sources.[3] The Alaska MIMR, however, does not currently conduct family interviews, nor do first responders in Alaska employ a standardized infant death scene investigation form when responding to such cases. Frequent barriers reported by infant mortality review programs around the country, including Alaska, are: incomplete information from medical records, limited participation of some agencies or providers on the team, and timeliness of obtaining data.[3]

Neonatal, post-neonatal, and overall infant mortality rates were higher for Alaska Natives compared with non-Natives regardless of etiologic category and within most evaluated sub-populations. These findings are consistent with previous studies of American Indian/Alaska Native (AI/AN) and other indigenous populations.[4,5,6] Studies generally have found a stronger association between race/ethnicity and post-neonatal than neonatal mortality.[4,7,8] The reasons for these findings are unknown, but may relate to a combination of ethnic differences in dietary, genetic, environmental, and health service factors.[8] Socio-economic status may also influence mortality, but it is unlikely this fully explains the racial differences in IMR.[9] The paucity of published research on causes of high infant mortality among indigenous peoples and lack of consensus about the causes of the higher infant mortality rates indicate a need for further study and analysis in this area.

Maternal drug use is a modifiable risk factor for infant mortality and other adverse child health outcomes. Maternal prenatal smoking can lead to an increased risk of spontaneous abortion, preterm and low birth weight birth, and infant mortality from SIDS and perinatal disorders.[10,11,12] Some studies suggest that cigarette smoking increases overall perinatal mortality by 150%.[11] Alcohol and illicit drug use during pregnancy, in addition to being associated with birth defects such as Fetal Alcohol Syndrome, is commonly linked to reports of child maltreatment and neglect, possibly reflecting the influence of other lifestyle variables and social stressors in environments where substance abuse is occurring.[13,14,15] The Alaska Pregnancy Risk Assessment Monitoring System (PRAMS) revealed that in 2001, 5.2% of women delivering a live birth consumed alcohol and 14.7% smoked tobacco during pregnancy. The prevalence of both behaviors significantly declined compared to 1991.[16] Recently, preconception care during routine health care visits has been promoted by the Centers for Disease Control and Prevention as an opportunity to screen for substance use and introduce interventions to prevent or manage drug use behaviors before a woman becomes pregnant.[17]

SIDS and asphyxia during sleep are currently considered as mostly preventable deaths. Thus, it is worrisome to see the increase in the SIDS/asphyxia-specific infant mortality rate in Alaska during the final years evaluated, particularly when considering that the US SIDS rate declined 11% from 2000-2001.[18] Some of the disparity, however, may have occurred due to differences in how SIDS is assigned as a cause of death in different areas of the

United States.[19] Additionally, we combined SIDS and asphyxia into a single category of death because of the difficulty in distinguishing these individual causes. Studies have consistently found that prone or side sleep positions, a soft sleep surface or non-standard bed, and maternal smoking are independent risk factors for SIDS.[20,21] The "Back to Sleep" campaign, initiated in Alaska during 1996, has been credited with much of the reduction in SIDS mortality observed in the 1990s. In Alaska, during 1996 to 2001, the proportion of women delivering live births who placed their infant to sleep on its back rose from 41% to 70%.[16] Bed sharing has many benefits for the mother and the baby,[22] and is a documented safe sleep option as long as the parent is unimpaired by tobacco, alcohol, or other drugs and sleeps on a standard non-water mattress.[23,24]

Neglect and abuse-related infant deaths represent a societal failure because all are preventable. In addition, these deaths should be considered sentinel events, reflecting a much larger occurrence of non-fatal neglect and abuse episodes with subsequent adverse behavioral and physical outcomes. Previous studies have documented that Alaska has one of the highest incidences of identified infant physical abuse and physical abuse mortality yet documented.[25] It is likely that neglect and abuse related deaths are underreported since their identification is difficult. Mortality reviews such as MIMR may allow public agencies to estimate more accurately the total burden of neglect and abuse-related deaths, and thus to advocate for interventions. Unfortunately, while many risk factors for neglect and abuse have been identified, few specific prevention measures have been consistently found to be effective. During 1995, Alaska initiated Healthy Families Alaska, a home visitation program for high-risk women using paraprofessionals as home visitors. Similar to some evaluated home visitation programs in other states,[26,27] Alaska's program did not lead to a demonstrable decrease in neglect and abuse episodes.[28] Other evaluations have found that home visitation programs were successful at decreasing maltreatment and Child Protective Services reports among specific sub-populations or using nurses rather than paraprofessionals as home visitors.[29,30,31]

Preterm birth and congenital anomalies contributed to a large proportion of infant deaths, yet most deaths within these categories do not have known causes or effective prevention measures. The category of congenital anomalies includes a variety of birth defects caused by both genetic and environmental factors and which have varying degrees of preventability and severity. Improved prenatal folic acid supplementation can reduce the prevalence of neural tube defects,[32] and counseling on alcohol use during pregnancy may decrease the incidence of FAS.[33] Combined, however, these causes contribute to only a small proportion of birth defect-related infant deaths. Preterm birth has been associated with various etiologies such as short or incompetent cervix and maternal gynecological infections, but efforts at prevention based on these associations have not proven successful.[34,35]

Recommendations

- Health-care providers should inform women of childbearing age that prenatal drug and tobacco use are risk factors for preterm and low birth weight births, as well as infant death due to SIDS, neglect/abuse, certain birth defects, and other perinatal issues.

- Further efforts should seek to identify causes for the disparities in infant mortality between Alaska Natives and non-Natives. Organizations providing health care to Alaska Natives should implement programs to reduce common and important risk factors for infant mortality.
- Health-care providers should educate caretakers of infants about the major known sleep-related risk factors for SIDS, including prone sleeping, bed-sharing with an impaired parent or a parent who smokes, and sleeping on a non-standard sleep surface such as a sofa or waterbed.
- Organizations involved in child neglect and abuse prevention should identify and implement science-based prevention strategies, as they become available.
- As there is no known means for preventing most preterm deliveries and the large number of resultant deaths, health-care providers should focus on early identification and referral of women at high risk of delivering a preterm infant, and referral of infants born preterm to appropriate treatment facilities.
- In order to facilitate the MIMR process, State and local law enforcement agencies should work together to develop and implement appropriate, standardized death scene investigation forms. Additionally, agencies involved with issues relevant to child mortality, such as the Office of Children's Services, law enforcement agencies, the Office of the Medical Examiner, and others, should work collaboratively with MIMR, and health-care providers should release medical records to the MIMR program on a timely basis.

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Figure 1. Trends in infant mortality; 3-year moving averages -- Alaska, 1992-1994 to 1999-2001

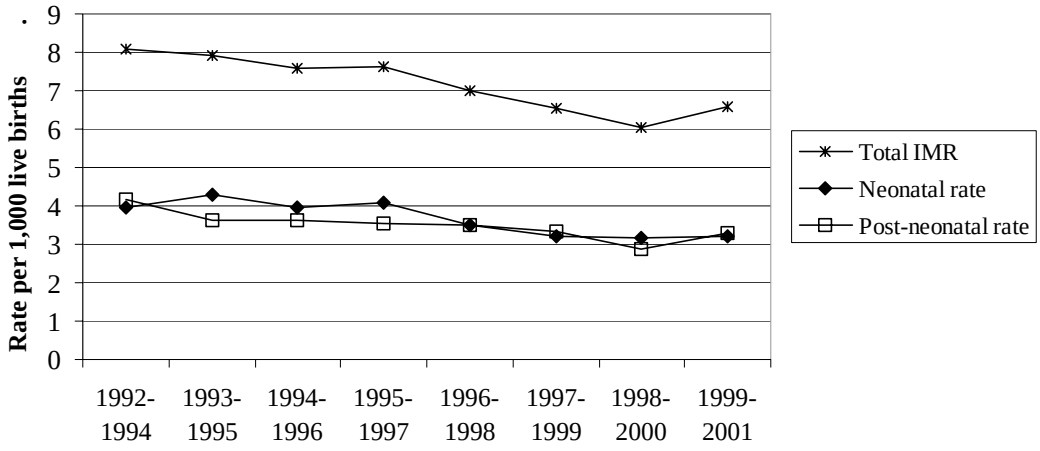

Figure 2. Percentage and number of neonatal and post-neonatal deaths by committee-determined causes -- Alaska MIMR, 1992-2001

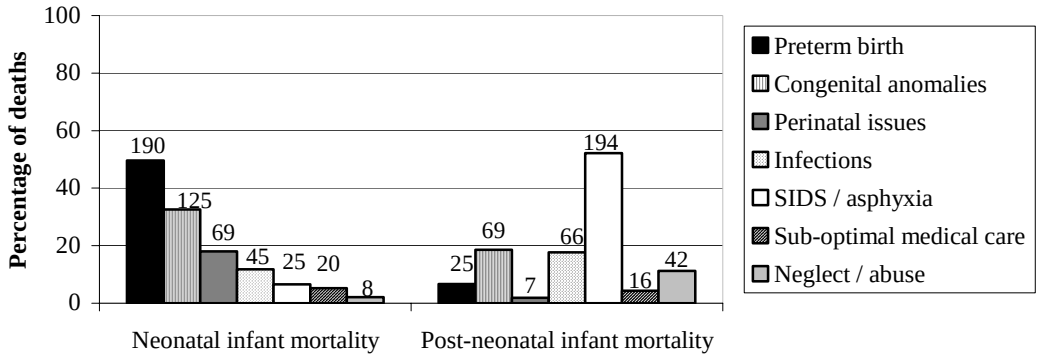

Figure 3. Trends in infant mortality by committee-determined causes; 3-year moving averages -- Alaska MIMR, 1992-1994 to 1999-2001

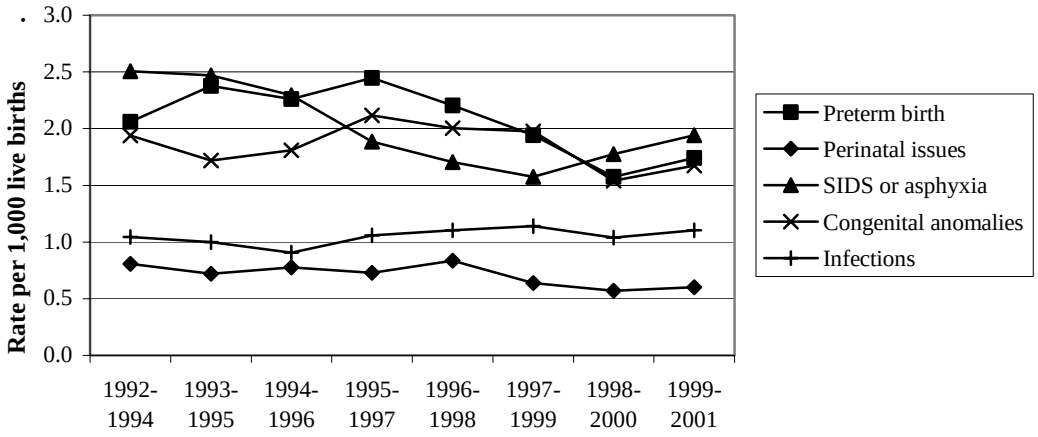

Figure 4. Rate ratios with 95% confidence intervals for the risk of cause-specific infant mortality among all preterm vs. term births -- Alaska MIMR, 1992-2001

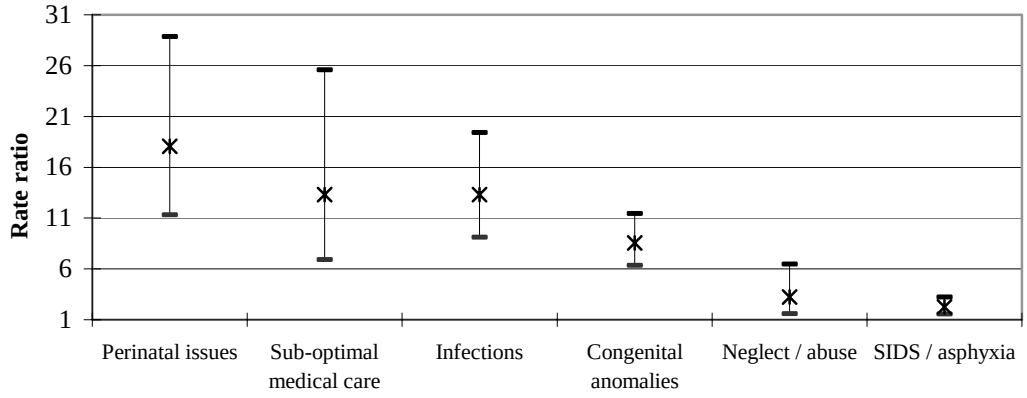

Figure 5. Percentage and number of infant deaths with drug use associated or noted within causes of death -- Alaska MIMR, 1992-2001

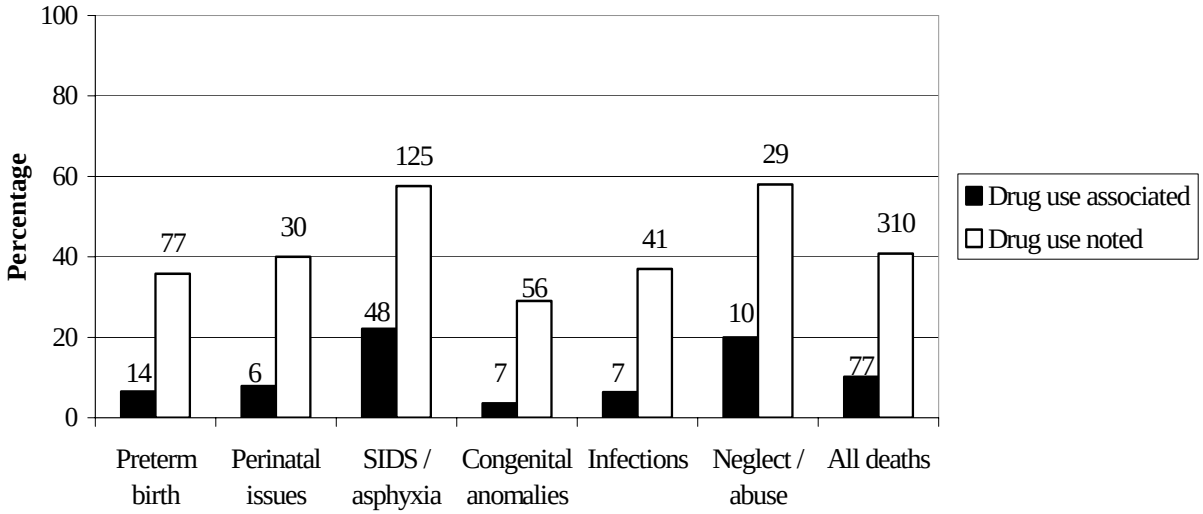

Table 1: Total, neonatal and post-neonatal infant mortality rates (IMR) per 1,000 live births by maternal risk factors; Alaska, 1992-2001*

Maternal Risk Factor	Infant deaths	IMR	Neonatal deaths	Neonatal IMR	Post-neonatal deaths	Post-neonatal IMR
Total	759	7.3	384	3.7	372	3.6
Education (years)						
<12	163	11.3†	57	4.0	106	7.4†
12	324	7.6	152	3.5	170	4.0
>12	214	4.9†	135	3.1	79	1.8†
Age (years)						
<20	123	10.6†	56	4.8†	67	5.8†
20-24	221	7.9†	87	3.1	133	4.7†
25-34	307	6.1	170	3.4	136	2.7
>34	105	7.8†	68	5.1†	36	2.7
Region of residence‡						
Anchorage/Mat-Su	356	7.0	181	3.5	174	3.4
Gulf Coast	66	6.2	34	3.2	31	2.9
Interior	110	6.3	62	3.5	48	2.7
Northern	60	11.4†	23	4.4	37	7.1†
Southeast	63	6.2	31	3.1	32	3.2
Southwest	101	11.4†	50	5.6†	50	5.6†
Race						
Alaska Native	278	11.4†	119	4.9†	158	6.5†
Non-Native	474	6.0	260	3.3	212	2.7

*Not all maternal risk factor information was known for all infants; date of death was unknown for 3 infants.

†Significantly different at the 95% confidence level from rates among women with 12 years of education, 25-34 years of age, residents of Anchorage/Mat-Su or non-Alaska Native, as appropriate.

‡See Appendix for map of Alaska showing regions

Table 2. Cause-specific* infant mortality rates (IMR) per 1,000 live births; Alaska MIMR-reviewed deaths, 1992-2001

	n	IMR
Total	755	7.3
SIDS/asphyxia	217	2.1
Preterm birth	215	2.1
Congenital anomalies	193	1.9
Infections	110	1.1
Perinatal issues†	76	0.7
Other causes	76	0.7
Neglect/abuse	50	0.5
Sub-optimal medical care	36	0.4
Unknown	33	0.3

*Allows for multiple causes of death

† e.g., placental abruption

Table 3. Leading causes of death and cause-specific infant mortality rates (IMR) per 1,000 live births by maternal risk factors; Alaska, 1992-2001*

Maternal Risk Factor	Top 3 Leading Causes	Deaths	IMR
Education (years)			
<12	SIDS/asphyxia	71	4.9
	Preterm birth	32	2.2
	Congenital anomalies	30	2.1
12	SIDS/asphyxia	97	2.3
	Preterm birth	93	2.2
	Congenital anomalies	80	1.9
>12	Preterm birth	71	1.6
	Congenital anomalies	62	1.4
	SIDS/asphyxia	42	1.0
Age (years)			
<20	SIDS/asphyxia	39	3.4
	Preterm birth	32	2.8
	Congenital anomalies	27	2.3
20-24	SIDS/asphyxia	86	3.1
	Preterm birth	47	1.7
	Congenital anomalies	40	1.4
25-34	Preterm birth	95	1.9
	Congenital anomalies	83	1.6
	SIDS/asphyxia	80	1.6
>34	Congenital anomalies	44	3.3
	Preterm birth	41	3.1
	Infections	16	1.2
Region of residence†			
Anchorage/Mat-Su	Preterm birth	107	2.1
	SIDS/asphyxia	97	1.9
	Congenital anomalies	84	1.6
Gulf Coast	Congenital anomalies	20	1.9
	SIDS/asphyxia	19	1.8
	Preterm birth	10	0.9
	Infections	10	0.9
Interior	Congenital anomalies	33	1.9
	Preterm birth	33	1.9
	SIDS/asphyxia	30	1.7
Northern	SIDS/asphyxia	22	4.2
	Preterm birth	17	3.2
	Infections	15	2.9
Southeast	SIDS/asphyxia	25	2.5
	Preterm birth	17	1.7
	Congenital anomalies	13	1.3
Southwest	Congenital anomalies	33	3.7
	Preterm birth	31	3.5
	SIDS/asphyxia	26	2.9

*Not all information was known for all infants.

†See Appendix for map of Alaska showing regions

Table 4. Cause-specific infant mortality rates (IMR) per 1,000 live births for sub-optimal medical care and neglect/abuse, by maternal risk factors; Alaska MIMR, 1992-2001*

Maternal Risk Factor	Sub-optimal medical care deaths		Neglect/abuse deaths	
	n	IMR	n	IMR
Total	36	0.4	50	0.5
Education (years)				
<12	4	--	18	1.3†
12	15	0.4	22	0.5
>12	15	0.3	9	0.2†
Age (years)				
<20	6	0.5	14	1.2†
20-24	9	0.3	12	0.4
25-34	16	0.3	19	0.4
>34	5	0.4	5	0.4
Region of residence‡				
Anchorage/Mat-Su	18	0.4	28	0.6
All non-Anchorage/Mat-Su	18	0.3	22	0.4
Race				
Alaska Native	12	0.5	20	0.8†
Non-Native	24	0.3	29	0.4

*Not all information was known for all infants.

†Significantly different at the 95% confidence level from rates among women with 12 years of education, 25-34 years of age, or non-Alaska Native, as appropriate.

‡See Appendix for map of Alaska showing regions

Table 5. Cause-specific infant mortality rates (IMR) per 1,000 live births for drug-associated and drug-noted deaths, by maternal risk factors; Alaska MIMR, 1992-2001*

Maternal Risk Factor	Drug-associated deaths		Drug-noted deaths	
	n	IMR	n	IMR
Total	77	0.7	310	3.0
Education (years)				
<12	31	2.2†	100	7.0†
12	35	0.8	150	3.5
>12	6	0.1*	38	0.9*
Age (years)				
<20	9	0.8	61	5.3†
20-24	32	1.1†	104	3.7†
25-34	30	0.6	121	2.4
>34	6	0.5	24	1.8
Region of residence‡				
Anchorage/Mat-Su region	33	0.6	129	2.5
All non-Anchorage/Mat-Su	44	0.8	181	3.5†
Race				
Alaska Native	49	2.0†	171	7.0†
Non-Native	27	0.3	137	1.7

*Not all information was known for all infants.

†Significantly different at the 95% confidence level from rates among women with 12 years of education, 25-34 years of age, residents of Anchorage/Mat-Su region, or non-Alaska Native, as appropriate.

‡See Appendix for map of Alaska showing regions

Table 6. Cause-specific* infant mortality rates (IMR) per 1,000 live births and rate ratios for Alaska Natives and non-Native Alaska residents; Alaska MIMR, 1992-2001

	Native IMR (n)	Non-Native IMR (n)	Rate Ratio	95% CI†
Summary				
All infant mortality	11.4 (278)	6.0 (474)	1.9	1.6-2.2
Neonatal mortality	4.9 (119)	3.3 (260)	1.5	1.2-1.8
Post-neonatal mortality	6.5 (158)	2.7 (212)	2.4	2.0-3.0
Cause-specific rates				
SIDS or asphyxia	4.0 (98)	1.5 (119)	2.7	2.0-3.5
Preterm birth	3.0 (73)	1.8 (139)	1.7	1.3-2.3
Congenital anomalies	2.7 (65)	1.6 (128)	1.6	1.2-2.2
Infections	1.8 (45)	0.8 (65)	2.2	1.5-3.3
Perinatal issues	0.8 (20)	0.7 (52)	1.2	0.7-2.1
Other causes	0.7 (16)	0.3 (27)	1.9	1.0-3.5
Neglect or abuse	0.8 (20)	0.4 (29)	2.2	1.2-3.9
Sub-optimal medical care	0.5 (12)	0.3 (27)	1.6	0.8-3.2
Unknown	0.5 (12)	0.3 (20)	1.9	1.0-4.0

*Allows for multiple causes of death

†Confidence interval

Table 7. Risk factor prevalence and infant mortality rates (IMR) per 1,000 live births and rate ratios (RR) for Alaska Natives compared with non-Natives, by maternal risk factors; Alaska, 1992-2001*

Maternal Risk Factor	Risk Factor Prevalence		IMR		RR (95% CI†)
	All Native births (N=24,396)	All non-Native births (N=78,620)	Native (n)	Non-Native (n)	
Education (years)					
<12	26.5	10.4	14.3 (90)	9.1 (73)	1.6 (1.2-2.2)
12	55.8	38.2	10.2 (135)	6.4 (189)	1.6 (1.3-2.0)
>12	17.7	51.4	7.4 (31)	4.6 (183)	1.6 (1.1-2.4)
Age (years)					
<20	17.2	9.3	12.2 (51)	9.8 (72)	1.2 (0.9-1.8)
20-24	30.2	26.2	10.8 (80)	6.8 (140)	1.6 (1.2-2.1)
25-34	42.6	50.6	11.3 (117)	4.7 (188)	2.4 (1.9-3.0)
>34	10.0	13.8	12.3 (30)	6.8 (74)	1.8 (1.2-2.8)
Region of residence‡					
Anchorage/Mat-Su	24.5	27.2	12.1 (72)	6.3 (282)	1.9 (1.5-2.5)
Gulf Coast	5.2	10.3	5.6 (7)	6.2 (58)	0.9 (0.4-2.0)
Interior	10.1	19.0	11.0 (27)	5.6 (83)	2.0 (1.3-3.1)
Northern	18.9	0.8	12.6 (58)	-- (<5)	--
Southeast	10.2	9.6	9.3 (23)	5.2 (39)	1.8 (1.1-3.0)
Southwest	31.2	8.6	12.0 (91)	7.8 (10)	1.5 (0.8-3.0)
Prenatal alcohol or tobacco use					
Yes	40.1	16.3	15.9	10.2	1.6 (1.2-2.0)
No	59.9	83.7	8.4	5.2	1.6 (1.3-2.0)

*Not all information was known for all infants.

†Confidence interval

‡See Appendix for map of Alaska showing regions

Appendix – Map of Alaska showing geographic regions evaluated for maternal residence status