APPENDIX B: TECHNICAL NOTES

HOW TO USE VITAL STATISTICS

VITAL EVENTS

Vital events are registered with the Bureau of Vital Statistics and include live births, fetal deaths (after at least 20 weeks gestation), adoptions, marriages, divorces, and deaths. Information on each of these events is provided on standard forms (see Appendix F).

RELIABILITY OF THE DATA

The reliability of vital records may vary depending on the data collection method. For instance, some information on birth and death certificates is collected and provided by health facilities or medical professionals (birth weight, complications of labor and delivery, cause of death, etc.), while other information is self-reported or reported by relatives (smoking during pregnancy, marital status of deceased, etc.). The Bureau of Vital Statistics makes every effort to complete, verify, and correct information which is missing, invalid, or inconsistent. Ultimately, the reliability of the data depends on everyone who is involved in data collection, storage and retrieval: Bureau staff, medical professionals, magistrates, funeral directors, marriage commissioners, judges, and each individual involved in, or witness to, a vital event.

COMPARING DIFFERENT POPULATIONS

Comparing the number of events in two separate locations may not be meaningful. We can guess that Anchorage will have more births than Juneau because Anchorage has a larger population. A more meaningful question is, what is the number of births compared to the size of the population? To make this comparison, we calculate a rate or a ratio by dividing the number of events by the population for which that event could have occurred. For instance, if there were 4,200 births in Anchorage and a population of 280,000 people, then the ratio of births to population would be 4200/280000 or 0.015 births for every person living in Anchorage. If there were 500 births in Juneau and a population of 30,000 then the ratio of births to population in Juneau would be 500/30000 or 0.016666 births for every person living in Juneau.

Since small decimal numbers are awkward to interpret, we change the ratio to a rate by multiplying it by a constant of proportionality. This constant of proportionality can be any number, as long as the same number is used in calculating every rate. To calculate birth rates, we usually use a constant of proportionality of 1,000. Using this method, the birth rate for Anchorage would be 0.015*1,000 or 15.0 births per 1,000 population. The birth rate for Juneau would be 0.016666*1,000 or 16.7 births per 1,000 population. This number is usually rounded to the nearest tenth (16.7). We can see that while there are fewer births in Juneau in this example, the rate per 1,000 population is greater.

The birth rates described in the last paragraph are crude birth rates because they compare events to the total population. A more meaningful comparison would use only the female population of childbearing ages (15–44 years of age). Let's assume that the number of women ages 15–44 in Anchorage is 60,000 and in Juneau is 7,300. The Anchorage fertility rate would be (4200/60000)*1000 or 70.0 births for every 1,000 women of childbearing age. The Juneau fertility rate would be (500/7300)*1000 or 68.5 births for every 1,000 women of childbearing age. While Anchorage would have a lower crude birth rate than Juneau in this example, the Anchorage fertility rate would be higher than for Juneau. This is because the ratio of women of childbearing age to the total population in Anchorage (60000/280000 or .2143) is lower than in Juneau (7300/30000 or .2433).

Please note that all of the numbers in the foregoing examples are hypothetical for purposes of illustration.

CONSTANT OF PROPORTIONALITY

In calculating crude birth rates and fertility rates, we used a constant of proportionality of 1,000. Vital statistics may be reported with different constants of proportionality. Readers should familiarize themselves with how rates are calculated so that validity is maintained when comparing rates. Unless rates are calculated with the same constant of proportionality, comparisons will lead to incorrect conclusions. For instance, in this report we calculate death rates per 100,000 population. If the another publication reported deaths per 1,000 population, you would need to convert the rates in this report (by dividing by 100) or the death rates in the other report (by multiplying by 100) in order to make a valid comparison.

SMALL POPULATIONS & FEW EVENTS

Data based upon small populations and few events require particular care in data analysis. In Alaska, variability is expected when looking at small groups within the population. Precautions are taken to avoid drawing false conclusions from random or unusual events. A method that is used in this report to provide greater reliability is moving averages. (For an explanation of moving averages, see "Vital Statistics Formulas" below.)

VITAL STATISTICS FORMULAS

AGE-ADJUSTED RATES

Age-adjusted rates are calculated so comparisons can be made between populations that have different age distributions. For example, a population with a high proportion of young people, generally will have a lower crude death rate than a population with a high percentage of elderly persons. Age-adjusted rates are more appropriate than crude rates when comparing health indicators for populations that have different age distributions. The age-adjusted rates in this report were calculated using the standard population based on the decennial U.S. Census of 2000 (see the Standard Population in Appendix A).

Age-Adjusted Death Rate = $\sum m_a \ (P_a/p)$

where:

$\sum$ is sum

m_a is the age-specific death rate

P_a is the standard population for the age group

p is the total standard population

MOVING AVERAGES

Calculations of 3-year, 5-year, and 10-year moving averages are performed when single-year rates are not reliable. When calculations are based on small numbers, moving averages can help to smooth out rates which vary widely from one year to another.

In Alaska, single-year infant mortality rates are seldom good indicators for the state of health within populations because rates can fluctuate dramatically from year to year. In Alaska, 132 infants died during 1988 and 108 infants died during 1989. The single-year infant mortality rates during 1988 and 1989 were 11.7 and 9.3, respectively. The 3-year moving average IMR (using 1986, 1987, and 1988 data) was 11.0 and (using 1987, 1988, and 1989) 10.4 infant deaths per 1,000 live births.

YEARS OF POTENTIAL LIFE LOST

Years of potential life lost (YPLL) is the difference between the standardized age of 75 and the age of a decedent who dies before age 75. For purposes of calculation, deaths are assumed to occur at the midpoint of a ten-year age interval; i.e. a 41-year-old decedent is assumed to be 39.5 years or halfway between 35 and 44. A person dying at age 41 would be said to have 35.5 years of life lost (75–39.5). Years of potential life lost emphasizes mortality in younger populations and is used in this report to measure the impact of specific causes of death. For a specific decedent group, Years of Life Lost is calculated as follows:

YLL = $\sum 75\text{-}mp$

Where:

YLL is years of life lost

$\sum$ is sum of all decedents' years of potential life lost

75 represents years of potential life

mp is the mid-point of the decedent's 10-year age group

STANDARD ERROR

The standard error of a statistic is the standard deviation of the sampling distribution of that statistic. Standard errors are important because they reflect how much sampling fluctuation a statistic will show. The inferential statistics involved in the construction of confidence intervals and significance testing are based on standard errors. The standard error of a statistic depends on the sample size. In general, the larger the sample size, the smaller the standard error. The standard error of a statistic is usually designated by the Greek letter sigma (σ) with a subscript indicating the statistic. For instance, the standard error of the mean is indicated by the symbol: σ_M.

EXPECTATION OF LIFE

Expectation of life is the number of years infants born in a specific year can expect to live if they experience the same age-specific death rates for all persons who died during their birth year. Table B.1 illustrates the calculation of life expectancy for all Alaskans based on data from the five year period 2003–2007.

TABLE B.1 EXPECTATION OF LIFE FOR ALL ALASKANS: 2003–2007

	A	B	C	D	E	F	G	H	I	J
Age at Death	Deaths	Population	Ratio	Proportion Dying in Age Group	Proportion living in Age Group	# Living at Beginning of Age Group	Number Dying in Age Group	# Living In Age Group	Cumulative Population	Years Left at Beginning of Age Group
<1	346	53,187	0.006505349	0.006484258	0.993515742	100,000	648	99,449	7,576,833	75.8
1-4	72	213,608	0.000337066	0.001347129	0.998652871	99,352	134	397,073	7,477,384	75.3
5-9	53	259,004	0.00020463	0.001022627	0.998977373	99,218	101	495,838	7,080,311	71.4
10-14	108	277,080	0.000389779	0.001946998	0.998053002	99,117	193	495,103	6,584,473	66.4
15-19	275	272,909	0.001007662	0.005025649	0.994974351	98,924	497	493,378	6,089,370	61.6
20-24	356	217,925	0.00163359	0.008134726	0.991865274	98,427	801	490,133	5,595,992	56.9
25-29	278	212,210	0.001310023	0.006528733	0.993471267	97,626	637	486,538	5,105,859	52.3
30-34	310	228,888	0.001354374	0.006749019	0.993250981	96,989	655	483,308	4,619,321	47.6
35-39	449	241,047	0.001862707	0.009270366	0.990729634	96,334	893	479,438	4,136,013	42.9
40-44	663	270,423	0.002451715	0.012183894	0.987816106	95,441	1,163	474,298	3,656,575	38.3
45-49	969	278,718	0.003476632	0.017233376	0.982766624	94,278	1,625	467,328	3,182,277	33.8
50-54	1150	252,489	0.004554654	0.022516878	0.977483122	92,653	2,086	458,050	2,714,949	29.3
55-59	1283	192,131	0.006677736	0.032840428	0.967159572	90,567	2,974	445,400	2,256,899	24.9
60-64	1226	124,526	0.009845334	0.048044141	0.951955859	87,593	4,208	427,445	1,811,499	20.7
65-69	1277	78,070	0.016357115	0.078572527	0.921427473	83,385	6,552	400,545	1,384,054	16.6
70-74	1511	54,393	0.02777931	0.129876828	0.870123172	76,833	9,979	359,218	983,509	12.8
75-79	1783	39,775	0.044827153	0.201548635	0.798451365	66,854	13,474	300,585	624,291	9.3
80-84	1695	25,275	0.067062315	0.287166455	0.712833545	53,380	15,329	228,578	323,706	6.1
85+	2406	19,410	0.123956723	0.473156342	0.526843658	38,051	38,051	95,128	95,128	2.5

Column A: **Total deaths during five years**

Column B: **Sum of population for each of the five years**

Column C: **Ratio** (A/B)

Column D: **Proportion dying in the age group** For less than 1 year: (2*C)/(2+C); for 1–4: years:(2*4*C)/(2+4*(1.25*C)); all others (2*5*C)/(2+5*C)

Column E: **Proportion living in age group** (1-D)

Column F: **Number living at beginning of age** For less than 1 year: 100,000; all others: E*F (both from next younger age group)

Column G: **Number dying in the age group** F (this age group)-F (next older age group)

Column H: **Number living in the age group** For less than one year: F-(.85*G); for 1–4 years: 4*F-(2.5*G); all others: (5*F)-(2.5*G)

Column I: **Cumulative population** Sum of H for this and all older age groups

Column J: **Years left at beginning of age** (I/F)