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.

COUNTING NUMBERS OF EVENTS

The most basic data available is the number of events. In any analysis, the most pertinent information must be determined and the limitations of that information must be identified. For instance, if you wanted to predict public school kindergarten enrollment, the most pertinent vital event data would be the number of live births in the period which qualifies children for enrollment. You would want to count only resident births for the geographic area of the appropriate schools. You would also need to consider limitations of this data, such as effects of infant and preschool mortality (this information can be obtained from death data), in-migration and out-migration, and alternatives to public school enrollment.

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. Two methods are used in this report to provide greater reliability: moving averages and confidence intervals. (For an explanation of each method, 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 LIFE LOST

Years of Life Lost (YLL), or Years of Productive Life Lost, is the difference between the standardized age of 65 and the age of a decedent who dies before age 65. For purposes of calculation, deaths are assumed to occur at the midpoint of a five-year age interval; i.e. a 41-year-old decedent is assumed to be 42.5 years or halfway between 40 and 45. A person dying at age 41 would be said to have 22.5 years of life lost (65–42.5). Years of 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:

$YLL = \sum 65\text{-}mp$

Where:

YLL is Years of Life Lost

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

65 represents years of productive life

mp is the mid-point of the decedent's 5-year age group

RELATIVE STANDARD ERROR

The relative standard error (RSE) is a measure of an estimate's reliability. The RSE of an estimate is obtained by dividing the standard error of the estimate (SE(r)) by the estimate itself (r). This quantity is expressed as a percent of the estimate and is calculated as follows:

RSE=100 x (SE(r)/r)

Estimates with large RSEs are considered unreliable.

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 2000–2004.

TABLE B.1 EXPECTATION OF LIFE FOR ALL ALASKANS: 2000–2004

COLUMN IDENTIFICATION AND DESCRIPTION										
	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	NUMBER LIVING AT BEGINNING OF AGE GROUP	NUMBER DYING IN AGE GROUP	NUMBER LIVING IN AGE GROUP	CUMULATIVE POPULATION	YEARS LEFT AT BEGINNING OF AGE GROUP
<1	344	50545	0.0068058166	0.0067827356	0.9932172644	100,000	678	99,423	7,536,375	75.4
1-4	95	203180	0.0004675657	0.0018680792	0.9981319208	99,322	186	396,823	7,436,951	74.9
5–9	39	260858	0.0001495066	0.0007472538	0.9992527462	99,136	74	495,496	7,040,128	71.0
10–14	115	285513	0.0004027838	0.0020118929	0.9979881071	99,062	199	494,812	6,544,632	66.1
15–19	292	261735	0.0011156322	0.0055626464	0.9944373536	98,863	550	492,939	6,049,820	61.2
20–24	312	202648	0.0015396155	0.0076685609	0.9923314391	98,313	754	489,680	5,556,881	56.5
25–29	280	210501	0.0013301600	0.0066287565	0.9933712435	97,559	647	486,178	5,067,201	51.9
30–34	303	232885	0.0013010713	0.0064842655	0.9935157345	96,912	628	482,990	4,581,023	47.3
35–39	512	259768	0.0019709895	0.0098066256	0.9901933744	96,284	944	479,059	4,098,033	42.6
40–44	715	286262	0.0024977119	0.0124110613	0.9875889387	95,340	1,183	473,740	3,618,974	38.0
45–49	966	274932	0.0035135961	0.0174150072	0.9825849928	94,156	1,640	466,682	3,145,234	33.4
50–54	1025	227435	0.0045067822	0.0222828509	0.9777171491	92,517	2,062	457,429	2,678,552	29.0
55–59	1072	157568	0.0068034119	0.0334481554	0.9665518446	90,455	3,026	444,712	2,221,123	24.6
60–64	1152	101097	0.0113949969	0.0553968666	0.9446031334	87,430	4,843	425,039	1,776,411	20.3
65–69	1154	67610	0.0170684810	0.0818497766	0.9181502234	82,586	6,760	396,032	1,351,372	16.4
70–74	1500	51682	0.0290236446	0.1353009092	0.8646990908	75,827	10,259	353,484	955,340	12.6
75–79	1722	36616	0.0470286214	0.2104054153	0.7895945847	65,567	13,796	293,347	601,856	9.2
80–84	1575	21615	0.0728660652	0.3081890226	0.6918109774	51,771	15,955	218,969	308,509	6.0
85+	1996	15613	0.1278421828	0.4843954764	0.5156045236	35,816	35,816	89,540	89,540	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)