APPENDIX B: TECHNICAL NOTES

HOW TO USE VITAL STATISTICS

Vital Events

Vital events registered with the Bureau of Vital Statistics 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 G.) Vital events do not include fetal deaths prior to the 20th week of gestation; living arrangements not formalized through adoption, marriage or divorce; or illnesses which do not result in death.

Reliability of the Data

Reliability of information 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 Number 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 want 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 *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 0.0166666 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 births per 1,000 population. The birth rate for Juneau would be 0.0166666*1,000 or 16.6666 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 total population. A more meaningful comparison would be to include in the population only women of child-bearing ages (15-44 years of age). We call this the *fertility rate*. This allows us to compare populations with different ratios of females of child-bearing ages. Let's assume that the number of women ages 15-44 in Anchorage is 66,500 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 child-bearing age. The Juneau fertility rate would be (500/7300)*1000 or 68.5 births for every 1,000 women of child-bearing 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 (66500/280000 or .2375) is lower than in Juneau (7300/30000 or .243333).

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 erroneous conclusions. For instance, in this report we calculate death rates per 100,000 population. If the National Center for Health Statistics (NCHS) reported deaths per 1,000 population, we would have to convert NCHS rates to 100,000 population for a valid comparison.

Small Populations and 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" in Appendix B.

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, "X" population which has a relatively high proportion of young people, generally will experience a lower crude death rate than "Y" population which is made up of a relatively high percentage of elderly. 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 million population based on the decennial U.S. Census of 1940. (See Standard Million Population in Appendix A.)

$$\text{age-adjusted death rate} = \sum m_a (P_a / p)$$

where: Σ 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

Confidence Intervals

In this report, confidence intervals are used to provide a range within which the true rate will fall with a probability of 95%. The size of the range is determined by the number of occurrences, the base population, and the standard error.

Using teen birth rate by census area as an example, refer to Chart 1.2B:

3-year births to teens ages 15-19 in 1995-1997 = 3,326 (*b*)

3-year annual female teen population in 1995-1997 = 63,687 (*p*)

Annual teen birth rate per 1,000 female teens = (3,326/63,687)*1,000 = 52.2 (*R*)

Standard error = $R/\sqrt{b}$ ci = $R \pm 1.96(R/\sqrt{b})$ ci= $52.2 \pm 1.96(52.2/\sqrt{3,326})$ or ci=50.4-54.0

We can say, then, that there is a 95% probability that the interval from 50.4 to 54.0 contains the true teen birth rate for the State of Alaska for the period 1995-1997.

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 experienced during their birth year. Table B.1 illustrates the calculation of life expectancy for all Alaskans based on data from a five year period.

TABLE B.1 EXPECTATION OF LIFE FOR ALL ALASKANS, 1993-1997

	COLUMN IDENTIFICATION AND DESCRIPTION									
	A	B	C	D	E	F	G	H	I	J
AGE AT DEATH	DTHS	POP	RATIO	PROPORTION DYING IN AGE GROUP	PROPORTION LIVING IN AGE GROUP	NO. LIVING AT BEGINNING OF AGE GROUP	NO. DYING IN AGE GROUP	NUMBER LIVING IN THE AGE GROUP	CUM POP	YEARS LEFT AT BEGINNING OF AGE GROUP
<1	402	52,373	0.00768	0.00765	0.99235	100,000	765	99,350	7,454,628	74.5
01-04	122	222,198	0.00055	0.00219	0.99781	99,235	218	396,397	7,355,278	74.1
05-09	67	283,566	0.00024	0.00118	0.99882	99,018	117	494,796	6,958,880	70.3
10-14	94	264,599	0.00036	0.00177	0.99823	98,901	176	494,065	6,464,084	65.4
15-19	255	212,746	0.00120	0.00598	0.99402	98,725	590	492,152	5,970,019	60.5
20-24	280	173,697	0.00161	0.00803	0.99197	98,135	788	488,707	5,477,867	55.8
25-29	351	227,088	0.00155	0.00770	0.99230	97,348	749	484,864	4,989,160	51.3
30-34	475	282,807	0.00168	0.00836	0.99164	96,598	808	480,971	4,504,295	46.6
35-39	538	308,944	0.00174	0.00867	0.99133	95,790	830	476,876	4,023,324	42.0
40-44	663	288,468	0.00230	0.01143	0.98857	94,960	1,085	472,087	3,546,449	37.3
45-49	672	228,950	0.00294	0.01457	0.98543	93,875	1,368	465,955	3,074,362	32.7
50-54	695	154,477	0.00450	0.02225	0.97775	92,507	2,058	457,392	2,608,406	28.2
55-59	814	102,234	0.00796	0.03903	0.96097	90,449	3,531	443,421	2,151,015	23.8
60-64	961	72,474	0.01326	0.06417	0.93583	86,919	5,578	420,650	1,707,594	19.6
65-69	1208	56,694	0.02131	0.10115	0.89885	81,341	8,228	386,136	1,286,945	15.8
70-74	1331	41,754	0.03188	0.14762	0.85238	73,113	10,793	338,585	900,808	12.3
75-79	1249	25,299	0.04937	0.21973	0.78027	62,320	13,694	277,368	562,224	9.0
80-84	1092	13,896	0.07858	0.32840	0.67160	48,627	15,969	203,211	284,856	5.9
85+	1363	8,471	0.16090	0.57373	0.42627	32,658	32,658	81,644	81,644	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 1 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

Moving Averages

Calculations of 3-year, 5-year, and 10-year moving averages are performed when single-year rates are not reliable. Often when small numbers are used for calculations, use of moving averages helps to smooth out rates which vary randomly from one period to another.

For example, single-year infant mortality rates are seldom good indicators of 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:

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

where:

YLL is Years of Life Lost

Σ 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