APPENDIX B: TECHNICAL NOTES

HOW TO USE VITAL STATISTICS

What Is a Vital Event?

Vital events registered with the Bureau of Vital Statistics are 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.

How Reliable Is the Data?

Reliability of information may vary depending on the 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 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 want to predict public school kindergarten enrollment, the most pertinent vital event data is the number of live births in the period which qualifies children for enrollment. You will want to count only resident births for the geographic area of the appropriate schools. Limitations of this data are effects of infant and preschool mortality (this information can be obtained from death certificates), in-migration and out-migration, and potential 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 are 4,200 births in Anchorage and a population of 280,000 people, then the ratio of births to population is 4200/280000 or 0.015 births for every person living in Anchorage. If there are 500 births in Juneau and a population of 30,000 then the ratio of births to population in Juneau is 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. Following 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. We would usually round this number 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 had a lower crude birth rate than Juneau in this example, the Anchorage fertility rate is 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 are 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 while the National Center for Health Statistics (NCHS) reports deaths per 1,000 population. For a valid comparison, we have converted NCHS rates to 100,000 population.

Small Populations and Few Events

Data based upon small populations and numbers of events require particular care in data analysis. In Alaska, for example, variability should be 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 validity to calculated rates. They are moving averages and confidence intervals. (For an explanation of each method, see "Vital Statistics Formulas" which follows.

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 1.3:

3-year births to teens ages 15-19 in 1993-1995 = 3,519 (*b*)

3-year annual female teen population in 1993-1995 = 57,105 (*p*)

Annual teen birth rate per 1,000 female teens = (3,519/57,105)*1,000 = 61.6 (*R*)

Standard error = $R/\sqrt{b}$

ci = $R \pm 1.96(R/\sqrt{b})$

ci= $61.6 \pm 1.96(61.6/\sqrt{3{,}519})$ or ci=58.1-65.2

We can say, for example, that there is a 95% probability that the interval from 58.1 to 65.2 contains the true teen birth rate for the State of Alaska for the period 1993-1995.

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. Tables B.1 and B.2 illustrate the calculation of life expectancy for all Alaskans based on data from a five year period. See Table B.2 for column explanations.

TABLE B.1 EXPECTATION OF LIFE FOR ALL ALASKANS, 1991-1995

	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	458	55,991	0.00818	0.00815	0.99185	100,000	815	99,308	7,416,874	74.2
01-04	120	235,685	0.00051	0.00203	0.99797	99,185	202	396,237	7,317,567	73.8
05-09	66	271,973	0.00024	0.00121	0.99879	98,984	120	494,618	6,921,330	69.9
10-14	88	253,737	0.00035	0.00173	0.99827	98,864	171	493,890	6,426,712	65.0
15-19	243	199,186	0.00122	0.00608	0.99392	98,692	600	491,961	5,932,822	60.1
20-24	331	214,288	0.00154	0.00769	0.99231	98,092	755	488,574	5,440,861	55.5
25-29	397	253,987	0.00156	0.00778	0.99222	97,337	758	484,793	4,952,287	50.9
30-34	509	294,106	0.00173	0.00862	0.99138	96,580	832	480,818	4,467,495	46.3
35-39	526	299,147	0.00176	0.00875	0.99125	95,748	838	476,642	3,986,677	41.6
40-44	607	263,621	0.00230	0.01145	0.98855	94,909	1,086	471,831	3,510,034	37.0
45-49	585	193,400	0.00302	0.01501	0.98499	93,823	1,408	465,594	3,038,203	32.4
50-54	632	134,414	0.00470	0.02324	0.97676	92,415	2,147	456,705	2,572,609	27.8
55-59	802	91,648	0.00875	0.04282	0.95718	90,267	3,865	441,674	2,115,904	23.4
60-64	973	69,764	0.01395	0.06739	0.93261	86,402	5,822	417,456	1,674,230	19.4
65-69	1158	52,737	0.02196	0.10408	0.89592	80,580	8,387	381,934	1,256,774	15.6
70-74	1206	37,267	0.03236	0.14969	0.85031	72,193	10,807	333,950	874,841	12.1
75-79	1121	21,075	0.05319	0.23474	0.76526	61,387	14,410	270,908	540,891	8.8
80-84	990	11,645	0.08502	0.35057	0.64943	46,977	16,468	193,712	269,983	5.7
85+	1132	8,102	0.13972	0.51775	0.48225	30,508	30,508	76,271	76,271	2.5

TABLE B.2 EXPECTATION OF LIFE FOR ALL ALASKANS, 1990-1994

	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	503	57,861	0.00869	0.00866	0.99134	100,000	866	99,264	7,404,245	74.0
01-04	119	234,443	0.00051	0.00203	0.99797	99,134	201	396,035	7,304,981	73.7
05-09	63	268,254	0.00023	0.00117	0.99883	98,933	116	494,377	6,908,946	69.8
10-14	88	243,014	0.00036	0.00181	0.99819	98,817	179	493,640	6,414,569	64.9
15-19	246	194,508	0.00126	0.00630	0.99370	98,639	622	491,638	5,920,929	60.0
20-24	350	214,508	0.00163	0.00813	0.99187	98,017	796	488,093	5,429,291	55.4
25-29	406	259,451	0.00156	0.00779	0.99221	97,220	758	484,208	4,941,198	50.8
30-34	505	297,978	0.00169	0.00844	0.99156	96,463	814	480,278	4,456,991	46.2
35-39	537	297,157	0.00181	0.00899	0.99101	95,649	860	476,093	3,976,712	41.6
40-44	558	253,394	0.00220	0.01095	0.98905	94,788	1,038	471,347	3,500,619	36.9
45-49	549	181,023	0.00303	0.01505	0.98495	93,750	1,411	465,225	3,029,273	32.3
50-54	611	126,131	0.00484	0.02393	0.97607	92,339	2,210	456,173	2,564,048	27.8
55-59	761	88,265	0.00862	0.04220	0.95780	90,130	3,803	441,140	2,107,875	23.4
60-64	981	68,097	0.01441	0.06953	0.93047	86,326	6,002	416,627	1,666,735	19.3
65-69	1151	51,040	0.02255	0.10674	0.89326	80,324	8,574	380,188	1,250,108	15.6
70-74	1139	34,863	0.03267	0.15102	0.84898	71,751	10,836	331,665	869,920	12.1
75-79	1066	19,937	0.05347	0.23582	0.76418	60,915	14,365	268,663	538,256	8.8
80-84	907	11,004	0.08242	0.34171	0.65829	46,550	15,907	192,984	269,593	5.8
85+	1034	7,435	0.13907	0.51597	0.48403	30,643	30,643	76,609	76,609	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.