APPENDIX B: TECHNICAL NOTES

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.)

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 1994-1996 = 3,437 (b)

3-year annual female teen population in 1994-1996 = 59,289 (p)

Annual teen birth rate per 1,000 female teens = (3,437/59,289)*1,000 = 58.0 (R)

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

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

ci= $58.0 \pm 1.96(58.0/\sqrt{3,437})$ or ci=56.0-59.9

We can say, for example, that there is a 95% probability that the interval from 56.0 to 59.9 contains the true teen birth rate for the State of Alaska for the period 1994-1996.

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, 1992-1996

	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	426	53,931	0.00790	0.00787	0.99213	100,000	787	99,331	7,423,112	74.2
01-04	123	232,759	0.00053	0.00211	0.99789	99,213	209	396,329	7,323,781	73.8
05-09	61	274,556	0.00022	0.00111	0.99889	99,004	110	494,744	6,927,451	70.0
10-14	91	261,621	0.00035	0.00174	0.99826	98,894	172	494,040	6,432,707	65.0
15-19	251	205,677	0.00122	0.00608	0.99392	98,722	601	492,109	5,938,668	60.2
20-24	325	212,477	0.00153	0.00762	0.99238	98,121	748	488,738	5,446,559	55.5
25-29	367	249,143	0.00147	0.00734	0.99266	97,374	715	485,083	4,957,821	50.9
30-34	499	287,604	0.00174	0.00864	0.99136	96,659	835	481,209	4,472,737	46.3
35-39	550	298,679	0.00184	0.00917	0.99083	95,824	878	476,927	3,991,528	41.7
40-44	625	270,623	0.00231	0.01148	0.98852	94,946	1,090	472,006	3,514,601	37.0
45-49	642	206,694	0.00311	0.01541	0.98459	93,856	1,446	465,665	3,042,596	32.4
50-54	673	142,344	0.00473	0.02336	0.97664	92,410	2,159	456,651	2,576,931	27.9
55-59	798	95,756	0.00833	0.04082	0.95918	90,251	3,684	442,044	2,120,280	23.5
60-64	988	71,126	0.01389	0.06712	0.93288	86,567	5,811	418,308	1,678,236	19.4
65-69	1204	54,348	0.02215	0.10495	0.89505	80,756	8,476	382,592	1,259,928	15.6
70-74	1279	39,324	0.03252	0.15039	0.84961	72,280	10,871	334,226	877,337	12.1
75-79	1163	22,433	0.05184	0.22947	0.77053	61,410	14,092	271,819	543,111	8.8
80-84	1047	12,199	0.08583	0.35332	0.64668	47,318	16,718	194,793	271,292	5.7
85+	1251	8,704	0.14373	0.52867	0.47133	30,599	30,599	76,499	76,499	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