

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 G).

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)

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

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

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 percent. 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:

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*)

$$\text{Standard error} = \frac{R}{\sqrt{b}}$$

$$ci = R \pm 1.96 \left(\frac{R}{\sqrt{b}} \right)$$

$$ci = 52.2 \pm 1.96 \left(\frac{52.2}{\sqrt{3,326}} \right) \text{ or } ci = 50.4-54.0$$

We can say, then, that there is a 95 percent 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 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 1997–2001.

TABLE B.1 EXPECTATION OF LIFE FOR ALL ALASKANS: 1997–2001

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	49,935	0.0068889556	0.0068653082	0.9931346918	100,000	687	99,416	7,518,453	75.2
1-4	99	203,412	0.000486697	0.0019444219	0.9980555781	99,313	193	396,771	7,419,037	74.7
5-9	57	276,190	0.0002063797	0.0010313662	0.9989686338	99,120	102	495,346	7,022,266	70.8
10-14	85	278,564	0.0003051363	0.0015245187	0.9984754813	99,018	151	494,713	6,526,920	65.9
15-19	275	243,527	0.0011292382	0.0056302963	0.9943697037	98,867	557	492,944	6,032,206	61.0
20-24	259	181,968	0.0014233272	0.0070914024	0.9929085976	98,311	697	489,810	5,539,262	56.3
25-29	288	202,046	0.001425418	0.0071017824	0.9928982177	97,613	693	486,334	5,049,452	51.7
30-34	335	241,393	0.0013877784	0.0069149013	0.9930850987	96,920	670	482,925	4,563,119	47.1
35-39	525	288,064	0.0018225117	0.0090712273	0.9909287727	96,250	873	479,067	4,080,193	42.4
40-44	673	297,147	0.0022648723	0.0112606018	0.9887393982	95,377	1,074	474,199	3,601,126	37.8
45-49	806	264,188	0.0030508577	0.0151388226	0.9848611774	94,303	1,428	467,945	3,126,927	33.2
50-54	871	198,453	0.0043889485	0.02170657	0.97829343	92,875	2,016	459,336	2,658,982	28.6
55-59	917	130,322	0.0070364175	0.0345738965	0.9654261035	90,859	3,141	446,443	2,199,646	24.2
60-64	993	84,348	0.0117726561	0.0571803687	0.9428196314	87,718	5,016	426,050	1,753,203	20.0
65-69	1,162	60,971	0.0190582408	0.0909574801	0.9090425199	82,702	7,522	394,705	1,327,154	16.0
70-74	1,515	47,451	0.0319276728	0.1478380515	0.8521619485	75,180	11,114	348,113	932,449	12.4
75-79	1,528	32,524	0.0469806912	0.2102135153	0.7897864847	64,065	13,467	286,658	584,336	9.1
80-84	1,343	17,409	0.077144006	0.3233573303	0.6766426697	50,598	16,361	212,087	297,678	5.9
85+	1,712	11,387	0.1503468868	0.5463713538	0.4536286462	34,237	34,237	85,592	85,592	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

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:

$$YLL = \sum 65 - mp$$

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