TECHNICAL NOTES

These *Technical Notes* explain the computation and interpretation of cause-specific death rates as used by the North Carolina Center for Health Statistics (SCHS) when computing Leading Causes of Death. Specifically, these *Technical Notes* apply to the SCHS web page "Leading Causes of Death" and publication *North Carolina Vital Statistics Volume 2, Leading Causes of Death*.

Computation of Death Rates

All cause-specific death rates here are expressed as resident deaths per 100,000 population. All rates use total population in the denominator, but rates for the sex-specific cancer sites use male or female population in the denominator. Population bases for these rates were provided by the Office of State Planning in the Governor's Office.

Deaths in this report are assigned to place of residence. For deaths of people in long-term institutions (mental, penal, old age, orphan, nursing home, rest home, etc.), the institution is considered the usual residence if the decedent lived in the institution at least one year. College students and military personnel are considered residents of the college or military community.

The following definitions apply to the rates of this report:

Unadjusted Annual Death Rate: The annual death rates are computed as resident deaths per 100,000 population. These rates reflect an area's status according to the observed deaths during the given year.

Unadjusted 5-Year Death Rate: The average annual death rates are computed as average resident deaths per 100,000 average population. These rates give an area's status with respect to the deaths during the 5-year period and are shown in state and county maps.

Age-adjusted Death Rate: The age-adjusted death rate is computed by the direct method. Also expressed as deaths per 100,000 population, these rates are those that **would be expected** if the age composition of each county's population were the same as that in a standard population (such as the state in 1990). These rates are not affected by age. However, the user should not compare an adjusted death rate to an unadjusted death rate. Also, adjusted rates for different time periods cannot be directly compared unless they were adjusted by the same standard population.

In age-adjusting the death rates in this publication, the following 10 age groups are used to compute age-specific death rates for each geographic area and cause of death. These death rates are then applied to the 1990 North Carolina standard population by age: 0-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85+.

For the maps, a clustering routine from the Statistical Analysis System (SAS) was used to group counties that are "most like each other" with respect to their unadjusted and their adjusted rate. These maps show five levels of death rates, where level one is the lowest rate interval and level five the highest.

A word of caution: Rates for sex-specific cancers (e.g., prostate) use male or female population in the denominator and therefore are not comparable to other rates. Thus, in ranking the causes of death – for example, in ranking the leading cancer sites – one must use the observed **numbers** of deaths rather than the rates.

Interpretation of Death Rates

To assess an area's relative mortality conditions during a 5-year period, both the unadjusted and the adjusted rate can be compared to the corresponding state rates for a particular cause of death. This, of course, should not be done if the area's unadjusted rate had fluctuated widely in recent years. The rate should represent a relatively stable situation. Then, the following alternative interpretations will apply:

Relative Status of Unadjusted Rate	Adjusted Rate	Interpretation of Unadjusted Rate
Low	Low	Low mortality is not due to age, other mortality conditions are favorable.
Low	High	Low mortality is due to favorable age distribution, other mortality conditions are unfavorable.
High	Low	High mortality is due to unfavorable age distribution, other mortality conditions are favorable.
High	High	High mortality is not due to age, other mortality conditions are unfavorable.

In using adjusted rates, it is important that the user understand the reason for adjustment. Example: A and B stand for population subgroups, e.g., older and younger persons or males and females.

	County			State		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Population A	300,000	1,000	333.3	500,000	2,500	500.0
Population B	10,000	10	100.0	800,000	1,000	125.0
Total	310,000	1,010	325.8	1,300,000	3,500	269.2

*Deaths per 100,000 population

Compared to the state, county subgroups A and B both have lower rates, but the county as a whole (A and B combined) has a higher rate. This seems to be a paradox that results from two factors – different proportions of A and B in the county vs. the state population and wide differences between the rates for A vs. B. In this example, it is true that the county has the higher total rate – BUT ONLY BECAUSE THE POPULATION CONTAINS A HIGH PROPORTION OF SUBGROUP A.

It is important for program planners to know that the county has a high rate relative to the state rate; this information is needed to determine manpower, facility, and related needs. But in assessing "risk," the researcher needs to adjust for confounding factors such as age. To do this, multiply each population-specific county rate by the corresponding "standard" population, sum these results, and divide by the total "standard." In the above example, using the state population as the standard, the computation is:

$$\frac{(1000/300{,}000 \times 500{,}000) + (10/10{,}000 \times 800{,}000)}{1{,}300{,}000} = 0.001897 \text{ or } 189.7 \text{ per } 100{,}000 \text{ population}$$

Thus, as rates specific for A and B imply, the county's rate is lower than the state's rate after adjustment for the factor represented by A and B.

Caution: In assessing the relative mortality conditions of a county, be particularly aware of rates based on small numbers of deaths since, in such cases, random fluctuation in the rate may render rate comparisons risky. The reader should read very carefully the next section entitled "Caution About the Use of Rates."

Caution About the Use of Rates

Small Number of Events

Any death rate with a small number of deaths in the numerator will have substantial random variation over time (a large standard error). A good rule of thumb is that any rate based on fewer than 20 events in the numerator may be subject to serious random error. As such, extreme caution and reservation should be taken when comparing or assessing trends with rates calculated with fewer than 20 events. Many of the death rates in this report have numerators smaller than 20. For more information on this topic, refer to the Statistical Primer *Problems with Rates Based on Small Numbers*, which is under "Publications" on this web site.

Adjusted Death Rates

Crude death rates are affected by the demographic composition of populations. As such, differences in demographic composition from one geographic area to another or from one point in time to another may hinder comparisons. The standardized adjustment of rates addresses this problem. The adjusted rate is a hypothetical rate computed in a way that reflects what the death rate would be in a particular geographic area, if the geographic area had the same age composition of the standard population. The measure, while useful for comparative purposes across time and geographic area, has no observable or descriptive value in and of itself. The adjusted rate provides opportunities for comparisons across time and geographic area as long as all rates that are to be compared share the same population standard and are adjusted for the same demographic categories.