Appendix C:
Technical Notes

AGE ADJUSTMENT: A BRIEF DEMONSTRATION

Rates of disease, death, and disability are strongly influenced by the age of a population. Younger populations are more likely to exhibit low rates of disease and death, while older populations are more likely to exhibit high rates of disease and death. In order to make valid health status comparisons across communities, it is important to control for age differences in the populations of those communities. Age adjustments control for rate differences based solely on differences in the relative ages of populations. For example, as the following tables illustrate, on a non age-adjusted basis, Easton has an overall mortality rate that is significantly higher than the mortality rate in Westville.

Easton

Age	Number of Persons	Deaths in Group	Crude Mortality Rate per 100,000
0 to 19	1,000	2	200
20 to 44	1,000	4	400
45 to 64	1,000	10	1,000
65 and older	1,000	20	2,000
Total	*4,000*	*36*	***900***

Westville

Age	Number of Persons	Deaths in Group	Crude Mortality Rate per 100,000
0 to 19	2,000	6	300
20 to 44	1,000	4	400
45 to 64	500	10	2,000
65 and older	500	10	2,000
Total	*4,000*	*30*	***750***

However, much of Westville's low overall mortality rate is explained by the relative youth of its population. While Westville's overall mortality rate is lower than Easton's, its age group-specific mortality rates are either comparable to or worse than Easton rates. Westville's overall mortality rate benefits from a relatively high concentration of young residents, who tend to have lower mortality rates than older residents.

Age adjustments control for such differences in age by applying a standard population distribution to comparison communities. By applying Easton's population distribution to Westville's age group mortality rates, we obtain an age-adjusted overall mortality rate for Westville which allows for valid comparisons across the two communities.

Westville: Age Adjusted

Age	Easton Age Distribution	Westville Mortality Rate per 100,000	Adjusted Westville Deaths	Adjusted Westville Mortality Rate per 100,000
0 to 19	1,000	300	3	-
20 to 44	1,000	400	4	-
45 to 64	1,000	2,000	20	-
65 and older	1,000	2,000	20	-
Total	*4,000*	-	*47*	***1,175***

As the above demonstrates, on an age-adjusted basis, Westville's mortality rate is significantly higher than Easton's. Valid comparisons of mortality rates, potential years of life lost (PYLL) rates, and incidence rates across communities require the type of age adjustments demonstrated above. Except where noted, all factbook analyses reflect age-adjusted rates.

CALCULATING POTENTIAL YEARS OF LIFE LOST

Potential years of life lost (PYLL) measures the extent to which persons in a community die before age 65.[1] PYLL rates are a function of both mortality rates and community residents' age at time of death. If mortality rates in two communities are equal and communities exhibit the same average age at time of death, PYLL rates in the two communities will also be equal, as the following tables demonstrate.

Northburg

Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	1	10	55.0	550.00
20-44	100	1	10	32.5	325.00
45-64	100	1	10	10.0	100.00
65+	100	1	10	0.0	0.00
Total	*400*	*4*	***10***	*97.5*	***243.75***

South City

Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	1	10	55.0	550.00
20-44	100	1	10	32.5	325.00
45-64	100	1	10	10.0	100.00
65+	100	1	10	0.0	0.00
Total	*400*	*4*	***10***	*97.5*	***243.75***

However, if mortality rates are equal but residents of one community die at an older age than residents of another (i.e., a higher proportion of deaths occur in the older age groups), the latter exhibits a lower PYLL rate. As the following tables demonstrate, although Northburg and South City have identical mortality rates, South City's PYLL rate is lower because its residents die at an older age than residents of Northburg.

Northburg

Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	1	10	55.0	550.00
20-44	100	1	10	32.5	325.00
45-64	100	1	10	10.0	100.00
65+	100	1	10	0.0	0.00
Total	*400*	*4*	***10***	*97.5*	***243.75***

South City

Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	0	0	0	0
20-44	100	0	0	0	0
45-64	100	2	20	20	200
65+	100	2	20	0	0
Total	*400*	*4*	***10***	*20*	***50***

If mortality rates across communities vary, PYLL rates will vary with an equal magnitude provided both communities exhibit the same average age at time of death. For example, if South City's mortality rate were twice as high as Northburg's, its PYLL rate would also be twice as high if residents of the two communities were dying at the same age.

However, variation in PYLL rates will differ from variations in mortality rates if communities do not exhibit the same average age at time of death. An older average age at time of death will minimize the effect of higher mortality rates on PYLL rates, while a younger average age at time of death will compound the mortality effect. For example, as the following tables demonstrate, although South City's mortality rate is twice as high as Northburg's, its PYLL rate is only 30 percent higher because South City residents are dying at an older age.

[1] While PYLL can be calculated using other reference ages (e.g., 70), public health experts indicate that age 65 is generally used for this type of analysis.

Northburg					
Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	1	10	55.0	550.00
20-44	100	1	10	32.5	325.00
45-64	100	1	10	10.0	100.00
65+	100	1	10	0.0	0.00
Total	*400*	*4*	***10***	*97.5*	***243.75***

South City					
Age	Pop	Deaths	Death Rate	PYLL	PYLL Rate
0-19	100	0	0	0	0
20-44	100	3	30	97.5	975
45-64	100	3	30	30	300
65+	100	2	20	0	0
Total	*400*	*8*	***20***	*127.5*	***318.75***

This example compares two communities with identical age distributions. Valid comparisons of PYLL rates across communities with different age distributions requires making age adjustments to control for these differences, as described earlier.

MORTALITY AGE INDEX: A BRIEF DEMONSTRATION

The mortality age index is a calculation that evaluates the rate at which a given population dies from a disease with the number of years of potential life lost by a population from the disease. The purpose of the index is to incorporate the rate at which a population dies from a given condition with the number of years of life lost before age 65 to determine whether the population dies at a younger, comparable, or older age relative to other populations. For example, the table below illustrates that in the two sample communities, residents of Easton die from cancer at younger ages compared to residents of Westville.

Column:	A	B	C	D	E	F	G
Disease Category	Easton Death Rate per 100,000	Easton PYLL per 100,000	Westville Adj. Death Rate per 100,000	Westville Adj. PYLL Rate 100,000	Difference in Adj. Death Rate	Difference in Adj. PYLL Rate	Mortality Age Index
Cancer (ICD 140-208)	200.0	700.0	300.0	400.0	-33.3%	75.0%	-108.3%
Equation Calculation					**=(A-C)/C**	**=(B-D)/D**	**=E-F**

CASE MIX ADJUSTMENT: A BRIEF DEMONSTRATION

Case mix adjustment is employed when considering inpatient utilization. Some inpatient utilization measures (e.g., days/1000, and Average Length of Stay or ALOS) are dependent not only on the demographic characteristics of the underlying inpatient population such as age and sex, but also on the clinical reasons for their inpatient admissions. For example, if one community has a much higher admission rate for lung transplants, their overall days/1000 and ALOS would appear higher, primarily due to the greater complexity of care experienced by that community's "case mix." To compare benchmark rates to Kansas City's experience, we must first control for these differences in the types of inpatient care provided. The level of adjustment occurs at the Diagnosis Related Group (DRG) level, as shown in the brief example below.

East Centerville (target community)			
DRG	**Admits**	**ALOS**	**Calc. E. C'ville Adj. Factor***
1	10	5.0	25%
2	10	7.0	25%
3	10	2.0	25%
4	10	4.0	25%
Total	***40***	***4.5***	***100%***

*Adjustment factor is based on the distribution of admits per DRG (here, 25% in each DRG).

West Centerville				
DRG	**Admits**	**ALOS**	**E. C'ville Adj. Factor**	**Adj. ALOS****
1	5	10.0	25%	2.50
2	5	3.0	25%	.75
3	15	5.0	25%	1.25
4	15	4.0	25%	1.00
Total	***40***	***5.0***	***1***	***5.50***

**Adjusted ALOS is calculated by multiplying the West Centerville ALOS by the East Centerville adjustment factor for each DRG.

The Total line for West Centerville shows that, when adjusted to the East Centerville case mix (25% of admits accounted for by each DRG), the ALOS is higher (5.5 days/admit) than was originally calculated (5.0 days/admit). This calculation eliminates the effect of the case mix, and allows us to make comparisons between the two communities based on inpatient care management, as measured by the ALOS.

Case mix adjustments are used in those cases where several DRGs are being considered as a "group," such as when we consider total ALOS and days/1000, or when we group DRGs by case type or by Major Diagnostic Category (MDC). Case mix adjustments are not used when considering individual DRG ALOS or days/1000 (because DRGs are not being grouped). Case mix adjustments are also not used when considering the admissions/1000 residents. The reason admits/1000 are not case mix adjusted is due to the fact that the number of admissions for a particular population is dependent on the characteristics of the underlying total population (e.g., age and sex), and not on the particular diseases or conditions involved (i.e., an admission for a lung transplant is counted the same as an admission for a tonsillectomy).