Abt

memorandum

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To: Bryan Hubbell & Zach Pekar, US EPA

From: Ellen Post & Don McCubbin

Subject: Methodology for County-Level Mortality Rate Projections

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This memorandum describes the development of the year 2000 through 2050 county mortality rates used in BenMAP. First, we describe the source of the 1996-1998 county-level mortality rates, and then we describe how we use national-level Census mortality rate projections to develop county-level mortality rate projections.

Mortality Rate 1996-1998

Age, cause, and county-specific mortality rates were obtained from the U.S. Centers for Disease Control (CDC) for the years 1996 through 1998. CDC maintains an online data repository of health statistics, CDC Wonder, accessible at http://wonder.cdc.gov/.[1] The mortality rates provided are derived from U.S. death records and U.S. Census Bureau postcensal population estimates. Mortality rates were averaged across three years (1996 through 1998) to provide more stable estimates. Population-weighted national mortality rates are presented in Exhibit 1.

[1] The CDC Wonder files were downloaded June 3, 2002.

Exhibit 1. National Mortality Rates in 1996-1998 for Selected Conditions, by Age Group

Mortality Category (ICD codes)	Mortality Rate by Age Group (deaths per 100 people per year)									
	Infant	1-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
All-Cause	0.246	0.034	0.093	0.119	0.211	0.437	1.056	2.518	5.765	15.160
Non-Accidental (ICD9 <800)	0.220	0.013	0.022	0.057	0.150	0.383	1.006	2.453	5.637	14.859
Chronic Lung Disease (ICD9 490-496)	0.001	<0.001	0.001	0.001	0.002	0.009	0.046	0.166	0.367	0.561
Lung Cancer (ICD9 162)	0.000	<0.001	<0.001	0.001	0.006	0.035	0.133	0.295	0.367	0.288
Cardio-Pulmonary (ICD9 401-440 460-519)	0.029	0.003	0.005	0.013	0.044	0.143	0.420	1.163	3.179	9.846

Source: We obtained county-level data for 1996-1998 from the CDC Wonder (http://wonder.cdc.gov/). The numbers presented here are population-weighted by total population in each county. (County-specific rates are used in the C-R functions.)

Mortality Rate Projections 2000-2050

To estimate age- and county-specific mortality rates in years 2000 through 2050, we calculated adjustment factors, based on a series of Census Bureau projected national mortality rates, to adjust the CDC Wonder age- and county-specific mortality rates in 1996-1998 to corresponding rates for each future year. The procedure we used was as follows:

- For each age group, we derived an estimate of the national mortality rate in 1997 (the midpoint year in the period 1996 - 1998) consistent with the series of Census Bureau projected national mortality rates, which starts in 1999.[2] We did this by regressing projected mortality rate on year, separately for each age group, using the ten years of Census Bureau projected rates from 1999 - 2008. The resulting estimated national age-group-specific mortality rates for 1997 are shown in Exhibit 2.
- We then calculated, separately for each age-group, the ratio of Census Bureau national mortality rate in year Y (Y = 2000, 2001, ..., 2050) to the national mortality rate in 1997, estimated in the previous step to be consistent with the Census Bureau series of rates starting in 1999. These ratios are shown for selected years in Exhibit 3.
- Finally, to estimate mortality rates in year Y (Y = 2000, 2001, ..., 2050) that are both age-group-specific and county-specific, we multiplied the CDC Wonder county-specific age-group-specific mortality rates for 1996-1998 by the appropriate ratio calculated in the previous step. For example, to estimate the projected mortality rate in 2010 among ages 18-24 in Wayne County, MI, we multiplied the CDC Wonder mortality rate for ages 18-24 in Wayne County in 1996-1998 by the ratio of Census Bureau projected national mortality rate in 2010 for ages 18-24 to (estimated) Census Bureau national mortality rate in 1997 for ages 18-24.

[2] Census Bureau projected mortality rates were derived from crude death rates using the following formula, given by Chiang (1967, p.2 equation 7): M = Q/(1-(1-A)*Q), where M denotes projected mortality rate, Q denotes crude death rate, and A denotes the fraction of the interval (one year) lived by individuals who die in the interval. A=0.1 if age < 1, and A=0.5 otherwise.

Exhibit 2. All-Cause Mortality Rate, by Source, Year, and Age Group

Source & Year	Mortality Rate by Age Group (deaths per 100 people per year)									
	Infant [b]	1-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
Census Bureau 2000	0.687	0.030	0.093	0.106	0.192	0.408	0.998	2.454	5.636	13.541
Est. Census Bureau 1997	0.706	0.031	0.095	0.108	0.199	0.421	1.032	2.555	5.787	13.846
CDC Wonder 1996-1998	0.246	0.034	0.093	0.119	0.211	0.437	1.056	2.518	5.765	15.160
Estimated 2000 [a]	0.239	0.033	0.091	0.116	0.204	0.424	1.022	2.419	5.615	14.826

[a] The estimate for 2000 is a population-weighted average of the county-level forecasts for 2000 that are calculated from the CDC Wonder county-level estimates and the ratio of the Census Bureau estimates for 2000 and 1997.

[b] Note that the Census Bureau estimate is for all deaths in the first year of life. The CDC Wonder estimate focuses on post-neonatal mortality (deaths after the first month), because the Woodruff et al (1997) study used to estimate premature mortality in infants examined post-neonatal mortality.

Exhibit 3. Ratio of Future Year All-Cause Mortality Rate to 1997 Estimated All-Cause Mortality Rate, by Age Group

Year	Ratio of Future Year to 1997 Mortality Rate, by Age Group									
	Infant	1-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
2000	0.97	0.97	0.97	0.98	0.97	0.97	0.97	0.96	0.97	0.98
2005	0.93	0.94	0.93	0.95	0.92	0.92	0.90	0.90	0.93	0.95
2010	0.88	0.88	0.88	0.91	0.87	0.88	0.86	0.84	0.89	0.91
2015	0.83	0.81	0.84	0.88	0.82	0.83	0.82	0.79	0.83	0.89
2020	0.78	0.76	0.79	0.86	0.77	0.78	0.78	0.76	0.77	0.86
2025	0.72	0.71	0.75	0.80	0.73	0.73	0.74	0.72	0.73	0.82
2030	0.66	0.66	0.70	0.75	0.68	0.68	0.69	0.70	0.71	0.77
2035	0.61	0.61	0.66	0.70	0.64	0.64	0.65	0.67	0.68	0.72
2040	0.56	0.56	0.62	0.66	0.60	0.60	0.60	0.63	0.65	0.70
2045	0.51	0.52	0.58	0.62	0.56	0.57	0.57	0.60	0.63	0.69
2050	0.47	0.48	0.55	0.58	0.53	0.53	0.54	0.56	0.59	0.68

Reference

Chiang, P.L. (1967). Variance and Covariance of Life Table Functions Estimated from a Sample of Deaths. National Center for Health Statistics. Washington, DC. Series 2 Number 20. March.