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MEMORANDUM | November 29, 2016

TO Elaine Shen and Tony Oliver, South Coast Air Quality Management District

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SUBJECT Review of Baseline Incidence Rate Estimates for Use in 2016 Socioeconomic Assessment

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In its role as the air pollution control agency for the South Coast Air Basin, the South Coast Air Quality Management District (SCAQMD) develops air pollution control plans to help this portion of California achieve compliance with Federal and State air quality standards. As part of the development of the regional Air Quality Management Plan (AQMP), SCAQMD considers its socioeconomic impacts, including its expected benefits and costs. The resulting AQMP Socioeconomic Analysis includes a detailed assessment of the benefits of reducing air pollutant concentrations, which requires the use of several datasets covering a wide array of information including, but not limited to, data on health condition incidence, demographics, concentration-response relationships, and economic values.

A review of the SCAQMD's past socioeconomic assessment by Abt Associates (2014) identified the following ways in which the benefits analysis could be strengthened:

- Instituting a more transparent and systematic process for conducting literature reviews relevant to the Socioeconomic Assessment;
- Clarifying the application of benefit transfer approaches that may be used to adjust concentration-response functions or benefit valuation inputs; and,
- Providing greater information about uncertainty in the benefits analysis, both qualitative and quantitative.[1]

As it prepares for the 2016 AQMP Socioeconomic Analysis, SCAQMD needs to ensure that it is applying the most up-to-date, scientifically-defensible methods and inputs for calculating the benefits to society resulting from air pollution strategies, addressing the issues noted above. In this memorandum, we provide our recommendations for the baseline incidence rate data to be used in the BenMAP benefits analysis to support the 2016 Socioeconomic analysis of the 2016 AQMP.

[1] Available at http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgt-plan/socioeconomic-analysis.

BACKGROUND

Development of appropriate baseline incidence values is a key step in assessing the potential health benefits of air quality strategies. In most cases, the concentration-response (C-R) functions that relate exposure with health outcomes express the change in incidence of a health endpoint as proportional to the baseline incidence of that endpoint. As a result, the use of local data, where available, is preferred for benefits analyses conducted at regional or metropolitan scales, especially where health incidence data is known or expected to exhibit significant spatial variability.

Appropriate selection of baseline incidence values involves obtaining data that best match characteristics such as the health endpoint of interest, the study location, the population of interest, and the time period of the analysis. For example, studies of hospital admissions endpoints may include a range of diagnoses that fall within a particular diagnostic category, expressed in terms of their ICD 9 or ICD 10 codes. Baseline incidence data collected for these endpoints should be based on queries for the same ICD codes specified in the study on which the C-R function is based. Baseline data should be location-specific; obtained at a geographic level appropriate to the analysis; and specific to the characteristics of the study population, if possible. Where baseline incidence estimates need to be generated for future years, they should be based on published projections where available.

ANALYTIC APPROACH AND RESULTS

This section describes our approach to developing baseline incidence data inputs for use in the 2016 Socioeconomic Analysis. For each of the health endpoints we have recommended for inclusion in the 2016 analysis, we searched the Internet for publicly available data.

Exhibit 1 presents our recommendations for sources of baseline incidence data for each of the health endpoints recommended for use in the 2016 Socioeconomic Analysis.

Mortality Rates

To establish baseline mortality rates at the county level for the SCAQMD analysis, we obtained data on death rates stratified by age for the four counties within SCAQMD's jurisdiction from the California Department of Public Health's Vital Statistics Query system for the years 2011 - 2013 (http://informaticsportal.cdph.ca.gov/CHSI/VSQS). We averaged the death rates for each county over these three years to account for potential year-to-year variation. We then used data from the U.S. Census projections of death rates to obtain age-specific ratios of deaths in 2012 to deaths in 2031 and applied these adjustments to the average SCAB county death rates to obtain estimated age-specific baseline death rates by county in 2031. This process was repeated for both all-cause and cardiovascular (ICD10 I00 – I99) mortality. This approach is consistent with the approach used by EPA to develop the baseline mortality forecasts included in BenMAP-CE (U.S. EPA, 2015); however should local projections become available, these would be preferred to national-level mortality data.

Morbidity Rates

County specific data on baseline rates of hospital admissions visits were obtained by querying free, publicly accessible databases from the Health Care Utilization Project (HCUP) HCUP-Net website (http://hcupnet.ahrq.gov). We rely on the State Inpatient Databases (HCUP-SID) which consist of hospital discharge records from State data organizations. HCUP-SID is composed of annual, state-specific files with clinical and non-clinical information on all patients, including persons covered by Medicare, Medicaid, private insurance, and the uninsured. Statistics include all community hospitals as defined by the American Hospital Association (AHA), minus long-term acute care hospitals. We opted to use this source because it provides data specific to the state of California.

Within the HCUP-Net databases we searched by ICD-9 code at the state level. (While HCUP-SID does include county specific estimates, these can only be queried using principal diagnosis data based on Clinical Classifications Software (CCS) categories. Our review of the ICD codes that comprise the CCS categories indicated that the cardiovascular and respiratory hospital admissions CCS categories for county-level data include some ICD codes not included in our endpoint definitions; thus, we chose to use the state-level data, which we were able to restrict to specific ICD codes. We queried HCUP-Net to obtain hospital admissions counts for cardiovascular and respiratory admissions for the State of California for respiratory and cardiovascular admissions for the years 2011-2013. We converted count data to incidence rates by dividing the HCUP counts by Census 2012 ACS 5-year population estimates for each specified population group.

For nonfatal myocardial infarctions and ischemic stroke, we obtained county-level incidence rate estimates from the CDC Interactive Atlas of Heart Disease and Stroke (http://nccd.cdc.gov/DHDSPAtlas), an online mapping tool that allows users to create county-level maps of heart disease and stroke incidence rates for Medicare beneficiaries aged 65 and older by race/ethnicity, gender, and age group. Hospitalization data in the atlas come from Centers for Medicare and Medicaid Services Medicare Provider Analysis and Review (MEDPAR) file, Part A. Deaths data come from the National Vital Statistics System maintained by the National Center for Health Statistics. Hospitalization data for acute myocardial infarction are adjusted for the percentage of fatal outcomes reported in the atlas to net out the non-fatal hospital admissions rate for this endpoint.

For asthma emergency department (ED) visits, we obtained baseline rate data for the four SCAB counties averaged over 2009 through 2011 from the HCUP State Emergency Department Database for California. These databases include discharge information on all ED visits within the state that do not result in a hospital admission.

For the endpoint of new onset asthma incidence in children, we recommended using the baseline rate of new asthma incidence in the Los Angeles area for 2002-2005 from the Children's Health Study cohort, reported in Table 1 of the study by McConnell et al., 2010. For prevalence estimates of asthma and upper respiratory symptoms in California,

we used results from the Centers for Disease Control's 2013 Behavioral Risk Factor Surveillance System (BRFSS) survey.[2]

For all other endpoints listed in Exhibit 1, current local baseline data were not readily available from publicly available sources, so we recommended that SCAQMD use the baseline incidence data included in BenMAP-CE for these endpoints.[3] These data can be found in the Other Incidence (2000) and Other Incidence (2007) databases included in the United States setup (U.S. EPA, 2015).

EXHIBIT 1. PROPOSED BASELINE INCIDENCE RATES (PER DAY UNLESS OTHERWISE SPECIFIED)

HEALTH ENDPOINT[a] (AGE RANGE)	PROJECTED RATE PER PERSON 2011-2013	PROJECTED RATE PER PERSON 2031	LOCATION	SOURCE
Mortality, All Cause (per year)				
25-34	6.99E-04	4.60E-04	Los Angeles	California Department of Public Health (CDPH)
35-44	1.23E-03	8.13E-04	Los Angeles	CDPH
45-54	3.12E-03	2.08E-03	Los Angeles	CDPH
55-64	6.88E-03	5.19E-03	Los Angeles	CDPH
65-74	1.48E-02	1.27E-02	Los Angeles	CDPH
75-84	3.88E-02	3.27E-02	Los Angeles	CDPH
85-99	1.17E-01	1.13E-01	Los Angeles	CDPH
25-34	8.99E-04	5.92E-04	Riverside	CDPH
35-44	1.37E-03	9.06E-04	Riverside	CDPH
45-54	3.36E-03	2.24E-03	Riverside	CDPH
55-64	8.03E-03	6.05E-03	Riverside	CDPH
65-74	1.65E-02	1.42E-02	Riverside	CDPH
75-84	4.22E-02	3.56E-02	Riverside	CDPH
85-99	1.26E-01	1.21E-01	Riverside	CDPH

[2] http://www.cdc.gov/brfss/brfssprevalence/index.html

[3] While we found a 2014 report from the California Attorney General's office documenting truancy rates by county for the 2013-2014 school year (https://oag.ca.gov/truancy/2014), we do not find this to be an appropriate baseline to use for the school-loss day endpoint because it includes non-illness related school absences. We also evaluated the BRFSS as a potential source for data on work loss days; however, we found the responses to the BRFSS survey question on work loss days suggested a mean work loss day rate in California surprisingly higher than the national average. This result appeared to be driven by a large number of respondents who did not work at all in the last month. We therefore decided to recommend use of the national incidence rate for this endpoint.

HEALTH ENDPOINT[a] (AGE RANGE)	PROJECTED RATE PER PERSON 2011-2013	PROJECTED RATE PER PERSON 2031	LOCATION	SOURCE
25-34	6.44E-04	4.24E-04	Orange	CDPH
35-44	9.87E-04	6.53E-04	Orange	CDPH
45-54	2.56E-03	1.71E-03	Orange	CDPH
55-64	5.55E-03	4.18E-03	Orange	CDPH
65-74	1.27E-02	1.09E-02	Orange	CDPH
75-84	3.89E-02	3.28E-02	Orange	CDPH
85-99	1.25E-01	1.20E-01	Orange	CDPH
25-34	9.22E-04	6.07E-04	San Bernardino	CDPH
35-44	1.55E-03	1.03E-03	San Bernardino	CDPH
45-54	3.98E-03	2.65E-03	San Bernardino	CDPH
55-64	9.06E-03	6.82E-03	San Bernardino	CDPH
65-74	1.96E-02	1.68E-02	San Bernardino	CDPH
75-84	5.01E-02	4.23E-02	San Bernardino	CDPH
85-99	1.40E-01	1.34E-01	San Bernardino	CDPH
Mortality, Cardiovascular (per year)				
25-34	8.13E-05	5.35E-05	Los Angeles	CDPH
35-44	2.38E-04	1.57E-04	Los Angeles	CDPH
45-54	8.58E-04	5.73E-04	Los Angeles	CDPH
55-64	2.17E-03	1.63E-03	Los Angeles	CDPH
65-74	4.81E-03	4.13E-03	Los Angeles	CDPH
75-84	1.43E-02	1.21E-02	Los Angeles	CDPH
85-99	5.44E-02	5.23E-02	Los Angeles	CDPH
25-34	9.20E-05	6.06E-05	Riverside	CDPH
35-44	2.68E-04	1.78E-04	Riverside	CDPH
45-54	8.50E-04	5.67E-04	Riverside	CDPH
55-64	2.32E-03	1.75E-03	Riverside	CDPH
65-74	5.27E-03	4.52E-03	Riverside	CDPH
75-84	1.50E-02	1.26E-02	Riverside	CDPH
85-99	5.81E-02	5.58E-02	Riverside	CDPH
25-34	5.53E-05	3.64E-05	Orange	CDPH
35-44	2.06E-04	1.36E-04	Orange	CDPH
45-54	5.76E-04	3.84E-04	Orange	CDPH
55-64	1.43E-03	1.08E-03	Orange	CDPH
65-74	3.40E-03	2.92E-03	Orange	CDPH
75-84	1.33E-02	1.12E-02	Orange	CDPH
85-99	5.56E-02	5.34E-02	Orange	CDPH

HEALTH ENDPOINT[a] (AGE RANGE)	PROJECTED RATE PER PERSON 2011-2013	PROJECTED RATE PER PERSON 2031	LOCATION	SOURCE
25-34	7.37E-05	4.85E-05	San Bernardino	CDPH
35-44	3.08E-04	2.04E-04	San Bernardino	CDPH
45-54	9.67E-04	6.45E-04	San Bernardino	CDPH
55-64	2.47E-03	1.86E-03	San Bernardino	CDPH
65-74	5.91E-03	5.07E-03	San Bernardino	CDPH
75-84	1.83E-02	1.54E-02	San Bernardino	CDPH
85-99	6.47E-02	6.21E-02	San Bernardino	CDPH
Hospital Admissions, All Cardiovascular (less Myocardial infarction)				
18-64	1.11E-05	1.11E-05	California	HCUP
65-99	9.07E-05	9.07E-05	California	HCUP
Hospital Admissions, Ischemic Stroke				
65-99	2.08E-05	2.08E-05	Los Angeles	CDC Atlas of Heart Disease and Stroke
65-99	1.92E-05	1.92E-05	Orange	CDC Atlas of Heart Disease and Stroke
65-99	2.25E-05	2.25E-05	Riverside	CDC Atlas of Heart Disease and Stroke
65-99	2.38E-05	2.38E-05	San Bernardino	CDC Atlas of Heart Disease and Stroke
Hospital Admissions, Respiratory				
18-64	9.47E-06	9.47E-06	California	HCUP
65-99	7.66E-05	7.66E-05	California	HCUP
Hospital Admissions, Chronic Lung Disease (less Asthma)				
18-64	1.68E-06	1.68E-06	California	HCUP
Hospital Admissions, Asthma				
0-18	3.01E-06	3.01E-06	California	HCUP
Acute Nonfatal Myocardial Infarction				
65-99	1.63E-05	1.63E-05	Los Angeles	CDC Atlas of Heart Disease and Stroke
65-99	1.24E-05	1.24E-05	Orange	CDC Atlas of Heart Disease and Stroke
65-99	2.04E-05	2.04E-05	Riverside	CDC Atlas of Heart Disease and Stroke
65-99	2.17E-05	2.17E-05	San Bernardino	CDC Atlas of Heart Disease and Stroke

HEALTH ENDPOINT[a] (AGE RANGE)	PROJECTED RATE PER PERSON 2011-2013	PROJECTED RATE PER PERSON 2031	LOCATION	SOURCE
Acute Bronchitis				
1-17	4.30E-02	4.30E-02	California	HCUP
Asthma Incidence, New Cases				
0-17	5.12E-05	5.12E-05	Los Angeles Area	CHS Cohort
Asthma-Related Emergency Department Visits				
0-18	7.93E-03	7.93E-03	Los Angeles	HCUP-SEDD
0-18	5.44E-03	5.44E-03	Orange	HCUP-SEDD
0-18	5.94E-03	5.94E-03	Riverside	HCUP-SEDD
0-18	8.59E-03	8.59E-03	San Bernardino	HCUP-SEDD
Lower Respiratory Symptoms				
7-14	1.32E-03	1.32E-03	United States	Schwartz et al. 1994
Upper Respiratory Symptoms				
5-17	1.46E-01 (prevalence)	1.46E-01 (prevalence)	California	Behavioral Risk Factor Surveillance System (BRFSS), 2013
Asthma Exacerbation				
5-17	1.46E-01 (prevalence, applies to cough, shortness of breath, and wheeze)	1.46E-01 (prevalence, applies to cough, shortness of breath, and wheeze)	California	Behavioral Risk Factor Surveillance System (BRFSS), 2013
18-99	1.44E-01 (prevalence)	1.44E-01 (prevalence)	California	BRFSS, 2013
Minor Restricted Activity Days				
18-64	2.14E-02	2.14E-02	United States	Ostro and Rothschild 1989
Work Loss Days				
18-64	5.95E-03	5.95E-03	United States	Adams et al. 1999
School Loss Days (per school day)				
5-17	2.06E-02	2.06E-02	Western United States	National Health Interview Survey

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