Economic Burden of Chronic Disease in California 2015

Estimated Health Care Cost of the Six Most Common Chronic Conditions at the County Level

California Department of Public Health

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2015

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A. Executive Summary

The purpose of the present study is to estimate the health care cost in 2010 for each of the 58 counties in California for treating the six most common chronic conditions: arthritis, asthma, cardiovascular disease (stroke, hypertension, coronary heart disease, and congestive heart failure), diabetes, cancer, and depression.

The county-level health care costs were estimated combining (1) nationally derived California-level data on medical expenditure per-person treatment costs for 2010 based on the Centers for Disease Control and Prevention (CDC) and Research Triangle Institute (RTI) International's *Chronic Disease Cost Calculator, Version 2* (Cost Calculator)[1] and (2) the estimated number of cases per specific condition in California based on the 2010 U.S. Census for population, the 2011–2012 California Health Interview Survey, and the National Cancer Institute Surveillance Epidemiology and End Result (SEER) data. Next, the estimated county-level health care costs by condition were adjusted using a geographic adjustment factor computed by the Institute of Medicine (IOM) to account for geographic variation in health care expenditure pricing. In addition, the percentage of the total health care costs for each county that may be due to these six chronic conditions was estimated using the average estimated annual 2009 health care expenditure of $6,238 per person, as calculated by the U.S. Health and Human Services Agency Centers for Medicare & Medicaid Services (CMS).[2, 3]

This study using statewide prevalence data estimates that approximately $98 billion was spent on treating six common chronic conditions (arthritis, asthma, cardiovascular disease, diabetes, cancer, and depression) in California in 2010. This represents approximately 42 percent of all health care expenditures in the State. Large variation in the health care cost of chronic conditions was found between counties, ranging from $3.5 million for Alpine to $25.4 billion for Los Angeles. The counties with the lowest percentage of estimated health care costs on the six chronic conditions were Kern (34%) and Kings (32%) counties, while the counties with the highest percentage of costs were Amador (62%), Marin (61%), Plumas (62%), and Tuolumne (63%) counties.

B. Introduction

Evidence suggests that more than half of Americans suffer from one or more chronic diseases; the estimated cost of medical services for treating these conditions exceeds $1 trillion annually nationwide.[4] Moreover, the rate of chronic diseases is expected to increase annually, and with it, the cost of treatment. For instance, by 2050, it is estimated that treatment costs will exceed $6 trillion nationwide.[5] Currently in California, 14 million people are estimated to be living with at least one chronic condition, and more than half of this group has multiple chronic conditions.[6] The advent of the federal Patient Protection and Affordable Care Act (ACA) provides an opportunity to address these challenges. As more people are covered by some form of health insurance, there is an opportunity to expand prevention services, especially to at-risk populations.

Information on the medical treatment cost of chronic conditions at the county-level can help community members in California to understand the scope of the problems facing the people in their jurisdiction and identify affected areas to target interventions and programs. The purpose of the present study is to estimate the health care cost in 2010 for each of the 58 counties in California for treating the six most common chronic conditions: asthma, arthritis, cancer, diabetes, cardiovascular disease, and depression.

C. Background

Only one county in California (San Diego County) has attempted to estimate the cost of chronic conditions at the county level.[7] Previous studies have estimated the cost of many common chronic conditions at the state or national level, including arthritis,[8, 9, 10] asthma,[11, 12] cancer,[13, 14] depression,[15] diabetes,[16, 17, 18] and heart disease.[19, 20, 21, 22] However, the estimated cost per person of a chronic condition varies widely across studies (Appendix A). A further difficulty with chronic disease prevention lies in translating national- or "big picture"-level data into information that helps local public officials invest in high-value interventions or prevention programs. Since 2007, the CDC PRISM (Prevention Impacts Simulation Model) has been available to help local public officials understand the health and cost outcomes of a number of interventions, including medical care (14 separate interventions), smoking (5), nutrition and weight loss (8), physical activity (4), emotional distress (2), and particulate air pollution (1).[23] Combining this type of information with the cost of the condition for each county may help direct prevention efforts at the local level.

This study was supported by CDC funds received by the California Department of Public Health (CDPH) in 2013-2014. Although the basic conceptual framework and calculations are the responsibility of the research team of the University of California, Merced (UCM), the analysis has benefited from the input and discussion of results with an Advisory Group (Appendix B) of researchers, policy makers, and practitioners in California. The present analysis was approved for an exemption by the UCM Institutional Review Board and was approved as a Common Rule

project with minimal risk by the Committee for the Protection of Human Subjects of the California Health and Human Services Agency.

D. Methods

Overview

The county-level health care costs in 2010 for treating the six most common chronic conditions were estimated for each of the 58 counties in California. These estimates provided the basis for calculating the percentage of total health care expenditure due to the six most common chronic conditions for each county.

The county-level health care cost per chronic condition was estimated by multiplying:

(1) Nationally derived California-level data on medical expenditure per person treatment costs per specific condition (Appendix C.1, Table 3);
(2) Expected number of cases per specific condition within each county (Table 1); and
(3) Geographic adjustment factor computed by the Institute of Medicine (IOM) of the National Academies for health care expenditure pricing for each county (Appendix C.3, Table 4).

The calculations, as described further below, account for the unique variation in age, gender, and racial/ethnic distributions, and health care expenditure pricing in each county (Table 2).

Next, the percentage of California's health care expenditures due to these six chronic diseases was estimated for each county (Table 3). The sum of the estimated health care cost for all six chronic diseases for each county was divided by an estimate of the total health care expenditure for each county. The total health care expenditure for each county was estimated by multiplying the population in the county (per the 2010 U.S. Census) with the average estimated annual 2009 health care expenditure of $6,238 for each person in California (as estimated by CMS).[2, 3]

Description of Data Components and Calculations

California-level estimates for 2010 medical expenditures per person for the six most common chronic diseases were obtained from the Cost Calculator and extrapolated to the 58 counties in California. The Cost Calculator, developed by CDC and RTI International (Appendix C.1), provides the costs per person for arthritis, asthma, cardiovascular diseases (stroke, hypertension, coronary heart disease, and congestive heart failure), diabetes, cancer, and depression. These costs are estimated from all payers (including uninsured) and represent the estimated average annual costs per person attributable to the diseases. Cost estimates for chronic conditions for gender- and age group- (0–17, 19–44, 45–64, 65–79, and ≥ 80 years) specific subpopulations were used in this analysis. The California-level medical expenditure estimates per person from the Cost Calculator were multiplied by the expected number of cases for the six most common chronic conditions in each county (Table 1) for gender- and age group-specific subpopulations. The expected number of cases was calculated using prevalence

estimates from state-wide California Health Interview Survey (CHIS) data for chronic conditions (non-cancer) and population registry data for cancer. Reliable county-level prevalence estimates for gender and age group-specific subpopulations (e.g., to match the Cost Calculator) using CHIS data were not possible due to small cell sizes.

California-level prevalence estimates for gender-, age group-, and racial/ethnic-specific (Hispanic, non-Hispanic [NH] White, NH Black, NH Asian, and NH Other) subpopulations were used for chronic conditions (non-cancer) in this analysis. These subpopulation estimates, when applied to U.S. Census counts for specific subpopulations in each county, account for varying gender, age, and racial/ethnic distributions in each county. Cancer county-level prevalence for gender-, age group-, and racial/ethnic-specific subpopulations were determined using registry data. The number of cases by county was obtained by multiplying the prevalence (California-level for survey data or county-level for registry data) and population count for specific subpopulations. Population counts for specific subpopulations for each county were from the *2010 Census Summary File 1, Table PCT12* provided by the California State Data Center.[24] These adjusted cost estimates for various subpopulations were then added together to get a county-level health care cost estimate for each chronic condition. Further details on the data sources for prevalence estimates are provided below:

1. **Chronic Condition (non-cancer) Prevalence**. CHIS 2011–2012[25] data (Appendix C.2) was used to estimate the disease prevalence in adults of arthritis, asthma, cardiovascular disease, and diabetes in California. Asthma prevalence was also estimated in children. The diabetes prevalence estimate of 0.3 for Americans under age 20 from the American Diabetes Association's *2011 National Diabetes Fact Sheet*[26] was used. Prevalence of both arthritis and cardiovascular disease is assumed to be minimal in children, thus 0 was used for the 0–17 age-group estimates.

2. **Cancer Prevalence.** Cancer prevalence estimates were obtained from the National Cancer Institute SEER data for counties within California. Cancer prevalence estimates for gender, age, and racial/ethnic subpopulations in California counties were calculated using the program SEER*Stat, version 8.1.5, and 2000–2010 SEER data.[27, 28] The following age groups were used to match those provided by SEER: 0–19, 20–44, 45–64, 65–79, and 80 years and older. Because of small sample sizes, no estimates were available for small counties, or for small demographic subgroups within counties. Small counties were therefore combined and average rates applied to each.

In summary, California-level estimates for 2010 medical expenditures per person for the six most common chronic conditions were obtained from the Cost Calculator and multiplied by the estimated number of cases per county. To account for price variation by different age and gender distributions of counties, all calculations were done based on gender- and age group-specific subpopulations. The sum across subpopulations resulted in the estimated county-level cost per condition. The final step in the analysis was to adjust for differences between counties in the cost per case resulting from variations in the price of health care services across the

State. Thus, the county-level cost estimates extrapolated from the Cost Calculator were multiplied by a county-specific Geographic Adjustment Factor (GAF)[29] computed by the Institute of Medicine (Appendix C.3).

E. Results

This study using statewide prevalence data estimates that approximately $98 billion was spent on treating six common chronic conditions (arthritis, asthma, cardiovascular disease, diabetes, cancer, and depression) in California in 2010. Overall, the estimated health care cost of treating these six chronic conditions is approximately 42 percent of all health care expenditures in California (Table 4). Specifically, this study estimates that in 2010 cardiovascular disease was associated with the greatest expense—an estimated $37 billion spent annually, or 16 percent of all health care costs. Asthma and depression have the lowest overall cost—each contributing approximately 4 percent to total health care expenditures in California. Finally, diabetes, arthritis, and cancer each contribute approximately 5.6 percent ($13 billion), 6.2 percent ($14 billion), and 6 percent ($14 billion), respectively, to the total health care expenditure amount.

The health care costs between counties varies widely—from $25.4 billion for Los Angeles County, $12.4 million in Sierra County, $8.2 billion for Orange County, $8.0 billion in San Diego County, $5.4 billion for Riverside County, to $3.5 million in Alpine County (Table 2). These costs are determined primarily by population size. Comparing the health care costs for chronic conditions as a percentage of total health care expenditures reveals variation between counties (Table 3). The counties with the lowest percentage of total health care expenditures on chronic conditions were Kern (34%) and Kings (32%) counties, while the counties with the highest percentage of expenditures on these six chronic conditions were Amador (62%), Marin (61%), Plumas (62%), and Tuolumne (63%) counties.

Table 1. Estimated number of cases[a] of people with each chronic condition by county in 2010

County	Population[b]	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression
Alameda	1,510,271	218,336	222,286	418,447	93,906	51,428	172,762
Alpine	1,175	243	188	399	79	28	168
Amador	38,091	8,624	5,588	14,727	2,707	1,950	5,032
Butte	220,000	40,384	33,363	68,735	12,526	9,544	29,949
Calaveras	45,578	10,465	6,758	17,472	3,248	2,108	6,146
Colusa	21,419	3,095	2,935	5,753	1,330	540	2,450
Contra Costa	1,049,025	167,618	154,299	304,846	64,824	41,704	127,579
Del Norte	28,610	5,074	4,353	8,738	1,670	1,037	3,804
El Dorado	181,058	35,030	26,975	58,061	10,966	7,648	24,603
Fresno	930,450	120,587	129,999	231,090	55,192	25,024	105,095
Glenn	28,122	4,501	3,992	7,997	1,668	1,054	3,440
Humboldt	134,623	24,371	21,106	40,531	7,359	5,397	19,233
Imperial	174,528	21,996	22,394	45,700	13,245	3,819	17,943
Inyo	18,546	3,942	2,805	6,768	1,281	856	2,439
Kern	839,631	107,222	118,562	201,337	46,823	19,465	98,681
Kings	152,982	18,419	21,450	35,939	8,642	2,901	17,765
Lake	64,665	13,386	9,640	22,613	4,294	2,754	8,649
Lassen	34,895	5,478	5,257	9,717	1,848	797	4,644
Los Angeles	9,818,605	1,350,222	1,361,104	2,663,982	654,248	318,960	1,088,838
Madera	150,865	21,781	21,096	40,432	9,337	4,450	17,683
Marin	252,409	50,603	36,979	85,808	16,137	15,141	33,061
Mariposa	18,251	4,240	2,728	7,096	1,305	802	2,485
Mendocino	87,841	16,788	13,077	28,443	5,437	3,799	11,658
Merced	255,793	31,651	35,436	60,732	14,767	6,057	28,647
Modoc	9,686	2,081	1,443	3,505	646	374	1,289
Mono	14,202	2,285	2,105	3,864	764	318	1,922

Table 1. Estimated number of cases[a] of people with each chronic condition by county in 2010

County	Population[b]	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression
Monterey	415,057	56,916	56,644	108,778	25,627	12,982	46,595
Napa	136,484	23,984	19,375	42,681	8,644	5,963	16,652
Nevada	98,764	21,968	14,699	36,399	6,485	5,209	13,521
Orange	3,010,232	437,307	421,104	812,481	179,726	105,859	344,726
Placer	348,432	63,682	51,948	107,764	20,212	13,483	46,369
Plumas	20,007	4,654	3,006	7,717	1,398	1,002	2,761
Riverside	2,189,641	315,480	309,485	590,492	133,040	59,351	256,089
Sacramento	1,418,788	212,246	214,626	384,490	80,586	49,173	177,862
San Benito	55,269	7,637	7,525	14,228	3,518	1,589	6,403
San Bernardino	2,035,210	263,377	289,274	502,224	120,858	52,152	238,175
San Diego	3,095,313	459,592	448,248	844,137	181,510	106,362	378,334
San Francisco	805,235	122,886	115,293	240,959	53,592	32,340	91,505
San Joaquin	685,306	92,529	98,526	174,710	40,068	18,623	78,894
San Luis Obispo	269,637	50,132	39,827	86,367	16,373	10,942	35,821
San Mateo	718,451	112,537	100,764	211,078	46,391	32,067	80,158
Santa Barbara	423,895	65,700	59,558	120,441	25,844	16,393	51,023
Santa Clara	1,781,642	240,551	248,430	463,783	105,711	62,542	189,258
Santa Cruz	262,382	42,657	37,977	74,223	15,404	10,217	33,948
Shasta	177,223	35,182	26,995	58,503	10,518	8,393	24,482
Sierra	3,240	776	478	1,281	237	146	446
Siskiyou	44,900	9,844	6,793	16,512	3,024	2,053	6,101
Solano	413,344	63,840	62,323	118,399	25,908	14,396	50,652
Sonoma	483,878	87,046	70,975	148,788	28,907	20,790	63,281
Stanislaus	514,453	73,320	73,552	132,932	29,472	14,507	62,348
Sutter	94,737	14,209	13,644	25,757	5,486	2,916	11,262
Tehama	63,463	11,704	9,365	19,888	3,805	2,613	8,327

Table 1. Estimated number of cases[a] of people with each chronic condition by county in 2010

County	Population[b]	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression
Trinity	13,786	3,187	2,099	5,295	973	650	1,909
Tulare	442,179	54,758	60,315	104,529	25,578	10,739	49,444
Tuolumne	55,365	12,312	8,215	20,872	3,781	3,286	7,432
Ventura	823,318	125,813	115,483	228,051	50,582	29,847	98,764
Yolo	200,849	27,896	29,211	50,380	10,754	5,996	24,889
Yuba	72,155	10,338	10,861	18,004	3,688	2,011	9,345
Total	**37,318,481**	**5,412,484**	**5,292,537**	**10,164,873**	**2,301,949**	**1,242,547**	**4,342,740**

[a]Estimated total number of people with this condition in California using prevalence from 2011–2012 California Health Information Survey,[25] Surveillance, Epidemiology, and End Results (SEER) 2000–2010 data,[28] and the American Diabetes Association, *2011 National Diabetes Fact Sheet*,[26] and population from the California State Data Center, *2010 Census Summary File 1, Table PCT12*.[24]

[b]Population estimates from the California State Data Center, *2010 Census Summary File 1, Table PCT12*.[24]

Table 2. Estimated health care cost[a] of chronic conditions by county in 2010

County	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression	Total
Alameda	$603,200,845	$416,651,921	$1,583,810,838	$559,846,687	$598,655,472	$425,155,263	$4,187,321,026
Alpine	$596,944	$366,967	$1,436,076	$403,210	$283,476	$421,641	$3,508,314
Amador	$23,335,555	$11,831,389	$60,004,057	$15,747,627	$22,678,304	$13,569,954	$147,166,887
Butte	$106,795,972	$62,434,861	$274,329,859	$72,334,458	$109,150,629	$72,129,961	$697,175,740
Calaveras	$28,087,993	$14,361,058	$70,558,179	$18,870,355	$23,974,424	$16,642,233	$172,494,242
Colusa	$7,990,069	$5,001,373	$21,050,853	$7,116,832	$5,922,104	$5,640,151	$52,721,383
Contra Costa	$469,937,735	$299,250,635	$1,211,111,316	$388,891,043	$494,678,284	$324,794,766	$3,188,663,779
Del Norte	$12,930,224	$8,027,006	$32,548,308	$8,927,040	$11,286,741	$9,095,277	$82,814,598
El Dorado	$89,215,578	$51,716,197	$217,569,923	$60,166,936	$82,370,516	$61,242,662	$562,281,813
Fresno	$305,789,841	$211,250,531	$808,862,366	$294,463,208	$268,349,029	$230,577,738	$2,119,292,713
Glenn	$11,739,159	$7,110,624	$30,311,474	$9,121,236	$11,635,207	$8,111,948	$78,029,648
Humboldt	$61,519,901	$38,722,535	$151,899,598	$40,220,171	$58,774,894	$45,404,362	$396,541,461
Imperial	$55,949,074	$36,324,821	$154,588,774	$72,238,607	$40,430,695	$39,783,079	$399,315,050
Inyo	$10,720,589	$5,722,643	$28,239,007	$7,470,878	$9,759,065	$6,347,939	$68,260,121
Kern	$262,830,425	$190,132,965	$671,492,969	$238,920,895	$203,208,952	$213,760,975	$1,780,347,182
Kings	$43,845,793	$33,480,435	$112,838,577	$42,915,901	$30,100,669	$37,466,087	$300,647,462
Lake	$35,413,535	$19,276,408	$89,479,100	$24,493,644	$31,236,210	$22,258,692	$222,157,588
Lassen	$13,148,960	$9,079,780	$32,448,597	$9,270,638	$8,415,193	$10,538,984	$82,902,152
Los Angeles	$3,574,208,392	$2,400,616,326	$9,579,361,879	$3,695,065,138	$3,567,291,013	$2,539,137,401	$25,355,680,148
Madera	$55,411,350	$36,081,461	$143,725,796	$49,446,160	$47,496,470	$40,504,021	$372,665,259
Marin	$145,286,826	$79,518,138	$367,294,263	$99,991,067	$182,558,622	$91,425,607	$966,074,523
Mariposa	$11,341,304	$5,832,104	$28,610,493	$7,544,800	$9,191,028	$6,734,940	$69,254,670
Mendocino	$43,869,916	$25,129,989	$110,852,435	$30,354,312	$41,949,416	$28,996,964	$281,153,032
Merced	$79,206,945	$56,404,903	$207,733,416	$77,289,002	$64,699,197	$62,010,549	$547,344,013
Modoc	$5,593,338	$2,954,470	$14,251,471	$3,725,272	$4,083,251	$3,391,060	$33,998,861
Mono	$5,333,561	$3,675,870	$12,435,183	$3,735,059	$3,092,737	$4,449,052	$32,721,462

Table 2. Estimated health care cost[a] of chronic conditions by county in 2010

County	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression	Total
Monterey	$145,238,687	$95,254,830	$384,687,421	$136,234,787	$142,621,186	$105,055,375	$1,009,092,286
Napa	$69,192,770	$39,353,263	$181,348,727	$52,852,239	$72,976,675	$44,266,337	$459,990,010
Nevada	$59,046,177	$30,580,542	$149,443,796	$38,150,475	$59,456,213	$35,784,249	$372,461,452
Orange	$1,200,821,811	$782,737,222	$3,132,330,779	$1,046,579,868	$1,224,119,385	$850,202,445	$8,236,791,511
Placer	$167,254,158	$97,546,613	$421,563,734	$115,650,919	$146,754,175	$112,566,473	$1,061,336,072
Plumas	$12,448,898	$6,394,841	$31,150,935	$8,108,658	$11,258,000	$7,465,113	$76,826,445
Riverside	$813,709,135	$526,735,895	$2,137,580,822	$717,813,688	$648,222,639	$581,161,863	$5,425,224,042
Sacramento	$535,870,514	$366,508,665	$1,367,255,028	$438,011,024	$526,290,551	$399,097,290	$3,633,033,073
San Benito	$18,859,647	$12,514,724	$48,363,545	$18,469,274	$16,584,444	$14,427,243	$129,218,877
San Bernardino	$643,433,398	$466,654,003	$1,652,748,449	$621,951,445	$539,142,219	$516,624,729	$4,440,554,243
San Diego	$1,164,903,557	$770,292,047	$3,025,071,838	$987,146,479	$1,148,337,336	$856,958,811	$7,952,710,067
San Francisco	$364,916,603	$238,823,878	$984,296,489	$356,839,887	$406,510,177	$240,580,980	$2,591,968,013
San Joaquin	$234,336,590	$162,459,110	$612,290,962	$214,654,322	$199,772,532	$174,186,299	$1,597,699,813
San Luis Obispo	$131,085,983	$75,571,203	$335,181,404	$92,499,798	$122,248,021	$87,680,987	$844,267,395
San Mateo	$338,300,223	$208,486,911	$901,149,172	$298,671,887	$406,413,572	$217,496,627	$2,370,518,391
Santa Barbara	$171,891,380	$105,352,991	$454,608,419	$143,411,773	$183,508,207	$118,876,484	$1,177,649,254
Santa Clara	$697,260,600	$477,758,939	$1,849,535,343	$652,351,457	$761,140,546	$486,886,691	$4,924,933,575
Santa Cruz	$105,753,024	$67,563,132	$262,565,319	$81,591,198	$108,375,540	$79,423,363	$705,271,576
Shasta	$93,160,668	$52,510,610	$234,525,831	$60,766,241	$94,309,971	$60,979,408	$596,252,729
Sierra	$2,048,997	$1,036,900	$5,055,401	$1,355,235	$1,645,669	$1,231,504	$12,373,706
Siskiyou	$26,532,352	$13,984,048	$67,887,328	$17,712,645	$23,262,973	$16,019,877	$165,399,224
Solano	$173,424,811	$117,208,931	$443,310,016	$150,875,202	$162,910,920	$124,579,029	$1,172,308,909
Sonoma	$225,640,815	$132,665,200	$569,745,118	$160,728,489	$226,359,415	$153,888,216	$1,469,027,254
Stanislaus	$184,921,719	$123,823,604	$474,089,392	$156,523,758	$154,312,254	$139,993,774	$1,233,664,501

Table 2. Estimated health care cost[a] of chronic conditions by county in 2010

County	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression	Total
Sutter	$36,864,012	$23,698,936	$95,548,634	$30,317,698	$31,782,892	$25,850,874	$244,063,046
Tehama	$30,829,593	$17,724,199	$77,834,396	$21,421,109	$29,134,259	$20,472,921	$197,416,478
Trinity	$8,418,767	$4,434,550	$21,100,931	$5,519,846	$7,426,006	$5,131,822	$52,031,923
Tulare	$137,552,295	$96,214,045	$361,160,115	$133,570,747	$115,831,945	$107,502,680	$951,831,827
Tuolumne	$33,398,552	$17,170,796	$85,752,176	$22,254,505	$38,074,375	$19,738,129	$216,388,532
Ventura	$338,130,092	$213,394,737	$868,583,588	$288,950,045	$337,506,353	$242,098,847	$2,288,663,662
Yolo	$68,736,320	$48,741,387	$174,477,936	$56,837,625	$62,968,498	$55,085,366	$466,847,131
Yuba	$25,367,216	$18,013,850	$62,338,978	$19,255,146	$21,163,615	$20,651,712	$166,790,518
Total	**$14,322,649,191**	**$9,442,166,010**	**$37,489,426,828**	**$12,985,647,649**	**$13,961,692,161**	**$10,241,556,826**	**$98,443,138,663**

[a]Estimated cost for each chronic condition in California derived using estimated number of cases, geographic adjustment factor for the region, and medical expenditure estimates from the *Chronic Disease Cost Calculator, Version 2*.[1]

Table 3. Percentage of total health care expenditure due to chronic conditions by county in 2010

County	Total health care expenditure[a]	Total health care cost on six chronic conditions[b]	Percentage of total health care expenditure due to six chronic conditions[c]
Alameda	$9,421,070,498	$4,187,321,026	44.4%
Alpine	$7,329,650	$3,508,314	47.9%
Amador	$237,611,658	$147,166,887	61.9%
Butte	$1,372,360,000	$697,175,740	50.8%
Calaveras	$284,315,564	$172,494,242	60.7%
Colusa	$133,611,722	$52,721,383	39.5%
Contra Costa	$6,543,817,950	$3,188,663,779	48.7%
Del Norte	$178,469,180	$82,814,598	46.4%
El Dorado	$1,129,439,804	$562,281,813	49.8%
Fresno	$5,804,147,100	$2,119,292,713	36.5%
Glenn	$175,425,036	$78,029,648	44.5%
Humboldt	$839,778,274	$396,541,461	47.2%
Imperial	$1,088,705,664	$399,315,050	36.7%
Inyo	$115,689,948	$68,260,121	59.0%
Kern	$5,237,618,178	$1,780,347,182	34.0%
Kings	$954,301,716	$300,647,462	31.5%
Lake	$403,380,270	$222,157,588	55.1%
Lassen	$217,675,010	$82,902,152	38.1%
Los Angeles	$61,248,457,990	$25,355,680,148	41.4%
Madera	$941,095,870	$372,665,259	39.6%
Marin	$1,574,527,342	$966,074,523	61.4%
Mariposa	$113,849,738	$69,254,670	60.8%
Mendocino	$547,952,158	$281,153,032	51.3%
Merced	$1,595,636,734	$547,344,013	34.3%
Modoc	$60,421,268	$33,998,861	56.3%
Mono	$88,592,076	$32,721,462	36.9%
Monterey	$2,589,125,566	$1,009,092,286	39.0%
Napa	$851,387,192	$459,990,010	54.0%
Nevada	$616,089,832	$372,461,452	60.5%
Orange	$18,777,827,216	$8,236,791,511	43.9%
Placer	$2,173,518,816	$1,061,336,072	48.8%
Plumas	$124,803,666	$76,826,445	61.6%
Riverside	$13,658,980,558	$5,425,224,042	39.7%
Sacramento	$8,850,399,544	$3,633,033,073	41.0%
San Benito	$344,768,022	$129,218,877	37.5%
San Bernardino	$12,695,639,980	$4,440,554,243	35.0%
San Diego	$19,308,562,494	$7,952,710,067	41.2%

Table 3. Percentage of total health care expenditure due to chronic conditions by county in 2010

County	Total health care expenditure[a]	Total health care cost on six chronic conditions[b]	Percentage of total health care expenditure due to six chronic conditions[c]
San Francisco	$5,023,055,930	$2,591,968,013	51.6%
San Joaquin	$4,274,938,828	$1,597,699,813	37.4%
San Luis Obispo	$1,681,995,606	$844,267,395	50.2%
San Mateo	$4,481,697,338	$2,370,518,391	52.9%
Santa Barbara	$2,644,257,010	$1,177,649,254	44.5%
Santa Clara	$11,113,882,796	$4,924,933,575	44.3%
Santa Cruz	$1,636,738,916	$705,271,576	43.1%
Shasta	$1,105,517,074	$596,252,729	53.9%
Sierra	$20,211,120	$12,373,706	61.2%
Siskiyou	$280,086,200	$165,399,224	59.1%
Solano	$2,578,439,872	$1,172,308,909	45.5%
Sonoma	$3,018,430,964	$1,469,027,254	48.7%
Stanislaus	$3,209,157,814	$1,233,664,501	38.4%
Sutter	$590,969,406	$244,063,046	41.3%
Tehama	$395,882,194	$197,416,478	49.9%
Trinity	$85,997,068	$52,031,923	60.5%
Tulare	$2,758,312,602	$951,831,827	34.5%
Tuolumne	$345,366,870	$216,388,532	62.7%
Ventura	$5,135,857,684	$2,288,663,662	44.6%
Yolo	$1,252,896,062	$466,847,131	37.3%
Yuba	$450,102,890	$166,790,518	37.1%
Total	**$232,390,177,528**	**$98,443,138,663**	**42.4%**

[a]Estimated by multiplying the population in each county (per the 2010 U.S. Census) by the average estimated annual 2009 health care expenditure of $6,238 for each person (as estimated by the Centers for Medicare & Medicaid Services).[2,3]

[b]Sum of the calculated costs of arthritis, asthma, cardiovascular disease, diabetes, cancer, and depression

[c]Total cost of chronic conditions divided by total cost of all health care in county

Table 4. Estimated health care costs of chronic conditions in California in 2010

	Estimated number of cases [a]	Percentage of total population[b]	Estimated health care costs [c]	Percentage of total health care expenditures [d]
Arthritis	5,412,484	19.36%[+]	$14,322,649,191	6.16%
Asthma	5,292,537	14.21%	$9,442,166,010	4.06%
Cardio-vascular Disease	10,164,873	36.36%[+]	$37,489,426,828	16.13%
Diabetes	2,301,949	6.18%	$12,985,647,649	5.59%
Cancer	1,242,547	3.34%	$13,961,692,161	6.01%
Depression	4,342,740	11.66%	$10,241,556,826	4.41%
Total	**28,757,130**		**$98,443,138,663**	**42.36%**

[a]Estimated total number of people with this condition in California using prevalence from 2011–2012 California Health Information Survey,[25] Surveillance, Epidemiology, and End Results (SEER) 2000–2010 data,[28] and the American Diabetes Association, *2011 National Diabetes Fact Sheet*,[26] and population from the California State Data Center, *2010 Census Summary File 1, Table PCT12*.[24]

[b]Estimated total number of cases divided by the total population of California (37,318,418 per 2010 U.S. Census).
[+] Estimated total number of cases divided by the *adult* total population of California

[c]Estimated cost for each chronic condition in California derived using estimated number of cases, geographic adjustment factor for the region, and medical expenditure estimates from the *Chronic Disease Cost Calculator, Version 2*.[1]

[d]Estimated total cost of each chronic condition divided by $232,792,684,478, the estimated total health care expenditure in California (calculated by multiplying 37,318,481, the population of California in 2010 per the U.S. Census, with the average estimated annual 2009 health care expenditure of $6,238 per person, as reported by the Centers for Medicare & Medicaid Services[2, 3]).

F. Conclusions

This study using statewide prevalence data estimates that approximately $98 billion was spent on treating the six most common chronic conditions (arthritis, asthma, cardiovascular disease, diabetes, cancer, and depression) in California in 2010. This is estimated to represent approximately 42 percent of all health care expenditures in the State. Large variation in the health care costs of chronic conditions was found among counties, ranging from $3.5 million for Alpine to $25.4 billion for Los Angeles. A unique contribution of this study was the variation among counties in the percentage of total health care expenditures in California that were accounted for by these six chronic conditions.

G. Discussion

Total health care costs range from $3.5 million for the 1,100 individuals in Alpine, to $25.4 billion for the 9.8 million individuals in Los Angeles. More interestingly, the analysis of

the percentage of total health care expenditures due to chronic conditions suggests that some counties (such as Amador, Marin, and Tuolumne counties) spend over 60 percent of their health care dollars on these six chronic conditions, whereas others (such as Kern and Kings counties) spend only one-third of their overall health care dollars. This is partly due to differing rates of these six chronic conditions among counties but is also influenced by the different age distribution in the counties (e.g., counties with an older population have more people with chronic conditions than those with younger populations) and the method with which total health care expenditure was estimated (i.e., use of an average statewide figure applied to each county rather than looking specifically at differences in health care expenditure between counties).

Reducing the rates of chronic conditions and their associated costs will require a concerted and coordinated effort. These efforts should include addressing the underlying factors identified as leading to these chronic conditions (e.g., tobacco use, poor nutrition, lack of physical activity, and excessive alcohol use). The systematic estimates of the rates and costs of chronic conditions found in this report provide a baseline to which future health expenditures can be compared. Local health agencies can use this information to guide chronic disease prevention interventions.

H. Limitations

Prevalence rates for only four broad racial/ethnic groups were used from CHIS (Hispanic, non-Hispanic (NH) White, NH Black, NH Asian, and NH Other), because of the smaller subgroup sample sizes of other racial/ethnic groups. Similarly, cost estimates for subgroups defined by gender and race/ethnicity were unavailable from the Cost Calculator because of small cell sizes. Use of these prevalence rates does not fully reflect the vast diversity of California's population, and thus the estimates do not allow a clear assessment of health conditions or costs for all subgroups.

The estimates for health care costs per condition derived in this study differ somewhat from the estimates from the Cost Calculator, especially for asthma (Table 5). The overall health care cost estimate of $98 billion is approximately 36 percent higher than the Cost Calculator medical expenditure estimate of $72 billion for California. The Cost Calculator relies on self-reported data of the treated population from the Medical Expenditure Panel Survey (MEPS), compared to prevalence estimates of those with the disease using 2011–2012 CHIS data, *SEER 2000–2010* data, and the American Diabetes Association's *2011 National Diabetes Fact Sheet.* In addition, the coding of chronic condition varies between the two data sources (Appendix C, Table 2). For the MEPS data, diseases were defined using ICD-9 codes based on self-reported diseases that were transcribed by professional coders. Of note, the Cost Calculator adjusts for co-morbidities, the CHIS prevalence data does not.

Table 5. Comparing health care cost estimates from the current study with Chronic Disease Cost Calculator medical expenditure estimates for California

	Health care cost estimates from current study	Medical expenditure estimates from cost calculator[a]	Difference (A – B)	Percentage (C/B)
	A	B	C	
Arthritis	$14,322,649,191	$11,490,000,000	$2,832,649,191	25%
Asthma	$9,442,166,010	$3,182,000,000	$6,260,166,010	197%
Cardiovascular Disease	$37,489,426,828	$25,156,000,000	$12,333,426,828	49%
Diabetes	$12,985,647,649	$12,095,000,000	$890,647,649	7%
Cancer	$13,961,692,161	$13,614,000,000	$347,692,161	3%
Depression	$10,241,556,826	$6,728,000,000	$3,513,556,826	52%
Total	**$98,443,138,663**	**$72,265,000,000**	**$26,178,138,663**	**36%**

[a]Sum of reported estimates for California of the conditions listed *Chronic Disease Cost Calculator, Version 2,* (Cost Calculator).[1, 22]

The current study represents an initial attempt to estimate the health care cost of chronic conditions in California. Additional analyses, beyond the scope of this project, are provided below to further clarify the limitations of this project.

County health services usage: The estimates in this study account for differences in the health care costs, based on the population distribution of the county (gender, age, and race/ethnicity), and prices in the region (using GAF), but do not account for differences in the intensity of health care usage for a given condition. These varying estimates can arise because of differences in the location of medical facilities, in provider practice between regions, and an individual's ability to pay for services.

Sensitivity analysis: As mentioned above, there is considerable uncertainty regarding the prevalence rates used in developing these estimates. One-way and probabilistic sensitivity analysis should be considered to test the assumptions and obtain confidence intervals.

Health and economic burden of chronic conditions: Estimating lost quality-adjusted life-years (QALYs), along with the cost estimates, would provide local public officials with information on the health impact of chronic conditions.

Although the Cost Calculator does include the impact of absenteeism in its cost estimates, it does not include losses in productivity due to the impact of chronic conditions on factors such as promotion or advancement in the workforce.

I. Future Considerations

One potential use of the results of the current study would be to help counties identify the return on investment (ROI) from prevention activities. A ROI or cost–benefit analysis requires understanding of not only the health care costs that could be avoided if chronic conditions were reduced and/or prevented, but also the cost incurred. Although technically not part of the health care costs associated with a chronic condition, losses in workforce productivity due to the impact of chronic conditions represent a significant loss to the individual and to society, and thus should be considered when examining the potential impact and ROI from a prevention activity. Moreover, infrastructure for health care providers and other organizations that would be needed to make the prevention activities successful can be considered.

Appendices

A. Previous Literature

Appendix A, Table 1. Per-person estimates for the cost of chronic conditions in the United States

Authors	Year	Condition	Per-person estimate
Center for Healthcare Research and Transformation[20]	2010	Asthma	$1,797
		Diabetes	$2,091
		Coronary Artery Disease	$4,623
National Cancer Institute[14]	2010	Initial phase of Cancer	$40,000
		Continuing care for Cancer	$50,000
		Last phase of Cancer	$38,000
American Academy of Allergy, Asthma, and Immunology [12]	2011	Asthma	$3,300
Arthritis Foundation[9]	2008	Arthritis	$2,600
Agency for Healthcare Research and Quality[22]	2008	Arthritis	$1,513
	2010–2011	Heart Disease	$4,769
		Cancer	$5,617
		Mental Health	$1,793
		COPD/Asthma	$1,481
		Diabetes	$2,325
American Diabetes Association[16]	2012	Diabetes	$7,900
Smith and Smith[15]	2010	Depression	$10,400
Centers for Disease Control and Prevention[21]	2014	Diabetes	$11,744
	2007	Asthma	$3,300
	2013	Arthritis	$3,331
	2007	Depression	$2,600
	2007	Cancer	$7,400

The cost of cancer is reported to be $7,400 per person per year by the Centers for Disease Control and Prevention (CDC), $5,617 per person per year by the Agency for Healthcare Research and Quality (AHRQ),[22] and over $100,000 by the National Cancer Institute (NCI) (Appendix A, Table 1).[14] This in part reflects different data sources, but also results from differences in the focus of the studies and methodology used to estimate the cost of the chronic condition. Cost methodologies can either focus on estimating the cost for a condition over the lifespan of the individual (prevalence approach) or the cost of the condition in a given year (incidence approach). The NCI, for instance, estimated the cost across the phases of cancer care, while AHRQ relied on data from a national, cross-sectional survey. Given these difficulties, CDC and Research Triangle Institute (RTI) developed the Chronic Disease Cost Calculator.

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C. Data Sources

Appendix C, Table 2. Comparison of data sources of the six most common chronic diseases conditions for the *Chronic Disease Cost Calculator, Version 2,* and for the current study

Condition	Age range years	Clinical Classification Codes for treated individuals used for *Chronic Disease Cost Calculator*[a]	Measures to estimate prevalence used in this study[b]
Arthritis	0 to 17	Not available	Not available
	≥ 18	ICD-9: 274, 354, 390, 391, 443, 446, 710–716, 719–721, 725–729	Ever diagnosed with arthritis, gout, lupus, or fibromyalgia
Asthma	0 to 17	Not available	Ever diagnosed with asthma
	≥ 18	CC: 128 ICD-9: 493	Ever diagnosed with asthma
Cancer	0 to 17	Not available	Invasive cancers
	≥ 18	CC: 11–43, 45	Invasive cancers
Cardiovascular Disease	≥ 18	Not available	Not available
• *Congestive heart failure*	≥ 18	ICD-9: 428	Ever told have heart failure/congestive heart failure
• *Coronary heart disease*	≥ 18	ICD-9: 410–414	Ever diagnosed with heart disease
• *Hypertension*	≥ 18	ICD-9: 401–405	Ever diagnosed with high blood pressure
• *Stroke*	≥ 18	ICD-9: 430–434, 436–438	Ever had a stroke
• *Other heart diseases*	≥ 18	ICD-9: 390–392, 393–398, 415–416, 420–427, 429	Not available
Depression	0 to 17	Not available	Likely has had frequent mental distress during past month
	≥ 18	ICD-9: 296, 311	Saw health professional for emotional/mental and/or alcohol–drug issues in past year
Diabetes	0 to 17	Not available	Diabetes prevalence
	≥ 18	ICD-9: 250	Ever diagnosed with diabetes

[a] Clinical Classification (CC) Code and 3-digit ICD-9 code from http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp using responses from 2004–2008 Medical Expenditure Panel Survey (MEPS) Consolidated Data Files.[1,22] Treated population is defined as the number of people receiving care for the disease in the previous year.

[b] Measures for prevalence of conditions in California per 2011–2012 California Health Information Survey,[25] Surveillance, Epidemiology, and End Results (SEER) Program 2000–2010 data (estimate for invasive cancer),[28] and the American Diabetes Association, *2011 National Diabetes Fact Sheet* (estimate for diabetes age 0-17 years).[26]

C.1 Chronic Disease Cost Calculator, Version 2

The Cost Calculator was developed by RTI International and supported by the Centers for Disease Control and Prevention (CDC) in collaboration with the Agency for Healthcare Research and Quality (AHRQ), the National Association of Chronic Disease Directors (NACDD), and the National Pharmaceutical Council (NPC).[1] The Cost Calculator provides state-level estimates of medical expenditures and absenteeism costs for six chronic diseases: arthritis, asthma, cardiovascular diseases (stroke, hypertension, coronary heart disease, and congestive heart failure), diabetes, cancer, and depression. The Cost Calculator is available for public download at (http://www.cdc.gov/chronicdisease/resources/calculator/index.htm). Total costs estimates of the average annual payer costs per person attributable to the disease represent the extent to which payer expenditures per person with the disease would be lower in the absence of the disease, all else held constant. Because the publicly available Cost Calculator provides estimates by gender or by age, a request was made to RTI Institute and CDC for cross-tabulated estimates of both gender and age groups (Appendix C.1, Table 3).

Appendix C.1, Table 3. Estimated costs per person treated for the six most common chronic conditions by age groups and gender in CA in 2010, Chronic Disease Cost Calculator, Version 2[a]

Chronic Condition	Cost per Person by Gender and Age Groups (yrs.)									
	Male					Female				
	0–17	18–44	45–64	65–79	80+	0–17	18–44	45–64	65–79	80+
Arthritis	--	$1,187	$1,830	$3,283	$3,632	--	$1,310	$1,952	$3,236	$4,596
Asthma	$809	$1,163	$2,147	$3,662	$3,950	$817	$1,343	$2,244	$4,495	$5,900
Cancer	$2,484*	$3,731	$6,956	$11,500	$13,459	$3,040*	$3,912	$7,233	$12,441	$16,883
Congestive heart failure	--	$2,611	$4,216	$7,306	$7,530	--	$2,160	$5,322	$10,824	$12,033
Coronary heart disease	--	$3,291	$4,428	$6,977	$7,251	--	$3,502	$5,794	$8,894	$9,211
Hypertension	--	$905	$1,233	$2,128	$3,176	--	$974	$1,300	$2,200	$4,595
Stroke	--	$4,272	$8,850	$12,694	$15,859	--	$4,676	$8,929	$14,925	$25,351
Diabetes	$1,588*	$2,389	$3,720	$6,405	$9,837	$1,701*	$2,917	$4,266	$7,349	$13,488
Depression	$1,172	$1,558	$2,827	$5,816	$7,184	$1,200	$1,742	$2,873	$5,755	$8,002

[a]The publicly available *Chronic Disease Cost Calculator, Version 2*, provides estimates by age or by gender.[1] The above cross-tabulation of both gender and age groups was provided by CDC.

*Unreliable estimated health care treatment costs due to very low prevalence rates of these conditions in 0-17 age group.

The methodology of the Cost Calculator is described elsewhere.[1] Briefly, estimates of the treated population and per person medical expenditures by sex and by age were determined by pooled data from the 2004–2008 Medical Expenditure Panel Survey (MEPS) Consolidated Data Files and the 2004 National Nursing Home Survey (NNHS). Diseases were defined using ICD-9 codes. Costs include expenditures for office-based visits, hospital outpatient visits, emergency room visits, inpatient hospital stays, dental visits, home health care, vision aids, other medical supplies and equipment, prescription medicines, and nursing home stays (see MEPS description below). All expenditure data were inflated to 2010 dollars using the gross domestic product general price index. Of note, many people who suffer from chronic disease may have multiple chronic conditions; therefore, the analyses accounted for the overlap of costs resulting from a person having multiple diseases.

Excerpt from online Agency for Health Care Research and Quality Medical Expenditure Panel Survey:[30]

> **Utilization and Expenditure Variables by Type of Medical Service**
>
> The following sections summarize definitional, conceptual, and analytic considerations when using the utilization and expenditure variables in this file. Separate discussions are provided for each MEPS medical service category. [Utilization and expenditure variables contained in the file can be identified in a table available online at http://meps.ahrq.gov/mepsweb/data_stats/download_data/pufs/h121/h121doc.shtml#TOC see Appendix 1.]
>
> **Medical Provider Visits (i.e., Office-Based Visits)**
>
> Medical provider visits consist of encounters that took place primarily in office-based settings and clinics. Care provided in other settings such as a hospital, nursing home, or a person's home are not included in this category.
>
> The total number of office-based visits reported for 2008 (OBTOTV08) as well as the number of such visits to physicians (OBDRV08) and nonphysician providers (OBOTHV08) are contained in this file. For a small proportion of sample persons, the sum of the physician and nonphysician visit variables (OBDRV08+OBOTHV08) is less than the total number of office-based visits variable (OBTOTV08) because OBTOTV08 contains reported visits where the respondent did not know the type of provider. Nonphysician visits (OBOTHV08) include visits to the following types of providers: chiropractors, midwives, nurses and nurse practitioners, optometrists, podiatrists, physician's assistants, physical therapists, occupational therapists, psychologists, social workers, technicians, receptionists/clerks/secretaries, or other medical providers. Separate utilization variables are included for selected types of more commonly seen nonphysician providers including chiropractors (OBCHIR08), nurses/nurse practitioners (OBNURS08), optometrists (OBOPTO08), physician assistants (OBASST08), and physical or occupational therapists (OBTHER08)…

As for the corresponding utilization variables, the sum of the physician and nonphysician visit expenditure variables (e.g. OBDEXP08+OBOEXP08) is less than the total office-based expenditure variable (OBVEXP08) for a small proportion of sample persons. This can occur because OBVEXP08 includes visits where the respondent did not know the type of provider seen.

Hospital Events

Separate utilization variables for hospital care are provided for each type of setting (inpatient, outpatient department, and emergency room) along with three expense variables per setting: one for basic hospital facility expenses, one for payments to physicians who billed separately for services provided at the hospital (referred to as "separately billing doctor" or SBD expenses) and one that aggregates the facility and SBD expenses (aggregated variable not included in files prior to 2008).

Hospital facility expenses include all expenses for direct hospital care, including room and board, diagnostic and laboratory work, x-rays, and similar charges, as well as any physician services included in the hospital charge. SBD expenses typically cover services provided to patients in hospital settings by providers like radiologists, anesthesiologists, and pathologists, whose charges are often not included in hospital bills.

Hospital Outpatient Visits

Variables for the total number of reported visits to hospital outpatient departments in 2008 (OPTOTV08) as well as the number of outpatient department visits to physicians (OPDRV08) and non-physician providers (OPOTHV08) are contained in this file. For a small proportion of sample persons, the sum of the physician and nonphysician visit variables (OPDRV08+OPOTHV08) is less than the total number of outpatient visits variable (OPTOTV08) because OPTOTV08 contains reported visits where the respondent did not provide information on the type of provider seen…

As for the corresponding utilization variables, the sum of the physician and nonphysician expenditure variables (e.g., OPVEXP08+OPOEXP08 for facility expenses) is less than the variable for total outpatient department expenditures (OPFEXP08) for a small proportion of sample persons. This can occur because OBFEXP08 includes visits where the respondent did not know the type of provider seen. No expenditure variables are provided for health care consultations that occurred over the telephone.

Hospital Emergency Room Visits

The variable ERTOT08 represents a count of all emergency room visits reported for the survey year… It should be noted that hospitals usually include expenses associated with emergency room visits that immediately result in an inpatient stay with the charges and payments for the inpatient stay. Therefore, to avoid the potential for double counting when imputing missing expenses, separately reported facility expenditures for

emergency room visits that were identified in the MPC as directly linked to an inpatient stay were included as part of the inpatient stay only (see below). This strategy to avoid double counting resulted in $0 facility expenditures for these emergency room visits. However, these $0 emergency room visits are still counted as separate visits in the utilization variable ERTOT08.

Hospital Inpatient Stays

Two measures of total inpatient utilization are provided on the file: (1) total number of hospital discharges (IPDIS08) and (2) the total number of nights associated with these discharges (IPNGTD08). Please note that the variable IPNGTD08 is an imputed version of the IPNGT08 variable released earlier on HC-115. For the 68 cases that were missing length of stay information, data were imputed using a weighted sequential hot-deck procedure. IPDIS08 includes hospital stays where the dates of admission and discharge were reported as identical. These "zero-night stays" can be included or excluded from inpatient analyses at the user's discretion (see last paragraph of this section)…

To the extent possible, payments associated with emergency room visits that immediately preceded an inpatient stay are included with the inpatient expenditures (see above) and payments associated with healthy newborns are included with expenditures for the mother (see next paragraph for more detail).

Data used to construct the inpatient utilization and expenditure variables for newborns were edited to exclude stays where the newborn left the hospital on the same day as the mother. This edit was applied because discharges for infants without complications after birth were not consistently reported in the survey, and charges for newborns without complications are typically included in the mother's hospital bill. However, if the newborn was discharged at a later date than the mother was discharged, then the discharge was considered a separate stay for the newborn when constructing the utilization and expenditure variables.

Some analysts may prefer to exclude zero-night stays from inpatient analyses and/or count these stays as ambulatory visits. Therefore, a separate use variable is provided that contains a count of the number of inpatient events where the reported dates of admission and discharge were the same (IPZERO08). This variable can be subtracted from IPDIS08 to exclude zero-night stays from inpatient utilization estimates. In addition, separate expenditure variables are provided for zero-night facility expenses (ZIFEXP08) and for separately billing doctor expenses (ZIDEXP08). Analysts who choose to exclude zero-night stays from inpatient expenditure analyses need to subtract the zero-night expenditure variable from the corresponding expenditure variable for total inpatient stays (e.g., IPFEXP08-ZIFEXP08 for facility expenses, IPDEXP08-ZIDEXP08 for separately billing doctor expenses).

Dental Care Visits

The total number of dental visits variable (DVTOT08) includes those to any person(s) for dental care including general dentists, dental hygienists, dental technicians, dental surgeons, orthodontists, endodontists, and periodontists. Additional variables are provided for the numbers of dental visits to general dentists (DVGEN08) and to orthodontists (DVORTH08). For a small proportion of sample persons, the sum of the general dentist and orthodontist visit variables (DVGEN08+DVORTH08) is greater than the total number of dental visits (DVTOT08). This result can only occur for persons who were reported to have seen both a general dentist and orthodontist in the same visit(s). When this occurred, expenditures for the visit were included as orthodontist expenses but not as general dentist expenses...

Home Health Care

In contrast to other types of medical events where data were collected on a per visit basis, information on home health care utilization is collected in MEPS on a per month basis. Variables are provided that indicate the total number of days in 2008 where home health care was received by the following: from any type of paid or unpaid caregiver (HHTOTD08), from agencies, hospitals, or nursing homes (HHAGD08), from self-employed persons (HHINDD08), and from unpaid informal caregivers not living with the sample person (HHINFD08). The number of provider days represents the sum across months of the number of days on which home health care was received, with days summed across all providers seen. For example, if a person received care in one month from one provider on 2 different days, then the number of provider days would equal 2. The number of provider days would also equal 2 if a person received care from 2 different providers on the same day. However, if a person received care from 1 provider 2 times in the same day, then the provider days would equal 1. These variables were assigned missing values if the number of provider days could not be computed for any month in which the specific type of home health care was received.

Separate expenditure variables are provided for agency-sponsored home health care (includes care provided by home health agencies, hospitals, and nursing homes) and care provided by self-employed persons...

Vision Aids

…for the purchase of glasses and/or contact lenses... Due to the data collection methodology, it was not possible to determine whether vision items that were reported in Round 3 had been purchased in 2006 or 2008. Therefore, expenses reported in Round 3 were only included if more than half of the person's reference period for the round was in 2008.

Other Medical Equipment and Services

This category includes expenditures for ambulance services, orthopedic items, hearing devices, prostheses, bathroom aids, medical equipment, disposable supplies, alterations/modifications, and other miscellaneous items or services that were obtained, purchased, or rented during the year. On this file, diabetic supplies and insulin are not considered to be medical equipment. All use and expenditure information for these items are included in the prescribed medicine variables. Respondents were only asked once (in Round 3) about their total annual expenditures and were not asked about their frequency of use of these services…

Prescribed Medicines

There is one total utilization variable (RXTOT08) and 13 expenditure variables included on the 2008 full-year file relating to prescribed medicines. These 13 expenditure variables include an annual total expenditure variable (RXEXP08) and 12 corresponding annual source of payment variables (RXSLF08, RXMCR08, RXMCD08, RXPRV08, RXVA08, RXTRI08, RXOFD08, RXSTL08, RXWCP08, RXOSR08, RXOPR08, and RXOPU08). The total utilization variable is a count of all prescribed medications purchased during 2008, and includes initial purchases and refills. The total expenditure variable sums all amounts paid out-of-pocket and by third party payers for each prescription purchased in 2008. No variables reflecting charges for prescription medicines are included because a large proportion of respondents to the pharmacy component survey did not provide charge data (see below).

Prescribed Medicines Data Collected

Data regarding prescription drugs were obtained through the household questionnaire and a pharmacy component survey. During each round of the MEPS-HC, all respondents were asked to supply the name of any prescribed medication they or their family members purchased or otherwise obtained during that round. For each medication and in each round, the following information was collected: whether any free samples of the medication were received; the name(s) of any health conditions the medication was prescribed for; the number of times the prescription drug was obtained or purchased; the year, month, and day on which the person first used the medication; and a list of the names, addresses, and types of pharmacies that filled the household's prescriptions. Also, during the Household Component, respondents were asked if they send in claim forms for their prescriptions (self-filers) or if their pharmacy providers do this automatically for them at the point of purchase (non-self-filers). For non-self-filers, charge and payment information was collected in the pharmacy component survey, unless the purchase was an insulin or diabetic supply/equipment event. However, charge and payment information was collected for self-filers in the household questionnaire, because payments by private third party payers for self-filers' purchases would not be available from the pharmacy component. Uninsured persons were treated as those whose pharmacies filed their prescription claims at the point of purchase.

Persons who said they did not know if they sent in their own prescription claim forms were treated as those who did send in their own prescription claim forms.

Pharmacy providers identified by the household were contacted by telephone in the pharmacy component if permission was obtained in writing from the person with the prescription to release their pharmacy records. The signed permission forms were provided to the various establishments prior to making any requests for information. Each establishment was informed of all persons participating in the survey that had prescriptions filled there in 2008 and a computerized printout containing information about these prescriptions was sought. For each medication listed, the following information was requested: date filled; national drug code (NDC); medication name; strength of medicine (amount and unit); quantity (package size and amount dispensed); and payments by source.

When diabetic supplies, such as syringes and insulin, were reported in the other medical supply section of the MEPS-HC questionnaire as having been obtained during the round, the interviewer was directed to collect information on these items in the prescription drug section of MEPS. Charge and payment information was asked for these events.

C.2 California Health Interview Survey

The California Health Interview Survey (CHIS) is a representative population-based, random-dial telephone health survey of non-institutionalized individuals in California and covers a wide range of health topics.[31] The survey provides statewide information on the health and health needs of the overall California population, including many racial and ethnic groups. For the 2011–2012 CHIS, a total of 42,935 adults, 2,799 adolescents, and 7,334 children were surveyed. CHIS was designed to meet two sampling objectives: (1) provide estimates for 41 large- and medium-size counties in California, and for groups of counties with the smallest populations; and (2) provide estimates for California's overall population, major racial and ethnic groups, and for several smaller ethnic subgroups. State-, regional-, and county-level estimations of various diseases and health-related behaviors surveyed in CHIS can be obtained from the online web tool *Ask*CHIS (http://ask.chis.ucla.edu/main/default.asp).[25] Because the 2011–2012 CHIS sample size was too small to obtain county-level prevalence rates for race/ethnicity and gender subgroups, the analysis was conducted with state-level prevalence rates (rather than county-level rates).

C.3 Geographic Adjustment Factor

Geographic Adjustment Factor (GAF) was created by the Institute of Medicine (IOM) and based on the Center for Medicare and Medicaid Studies (CMS), Medicare's Geographic Practice Cost Index (GPCI) for California.[29] The GAF takes into account geographic differences resulting from three factors: cost of physician services, practice expenses resulting from location (e.g., rent and cost of operating a facility), and geographic differences in malpractice or professional indemnity. The majority of the reimbursement is determined by the physician work (52%) and the practice expense (44%), with malpractice (4%) being a relatively small component. GAFs were calculated for nine payment localities that represent groups of counties within California.

Appendix C.3, Table 4: Geographic adjustment factors for counties in California calculated by the Institute of Medicine from Medicare's geographic practice cost index (GPCI) for California.

County	Geographic Adjustment Factors	County	Geographic Adjustment Factors
Alameda	1.1272	Orange	1.11
Alpine	1.0323	Placer	1.0323
Amador	1.0323	Plumas	1.0323
Butte	1.0323	Riverside	1.0323
Calaveras	1.0323	Sacramento	1.0323
Colusa	1.0323	San Benito	1.0323
Contra Costa	1.1272	San Bernardino	1.0323
Del Norte	1.0323	San Diego	1.0323
El Dorado	1.0323	San Francisco	1.1841
Fresno	1.0323	San Joaquin	1.0323
Glenn	1.0323	San Luis Obispo	1.0323
Humboldt	1.0323	San Mateo	1.1817
Imperial	1.0323	Santa Barbara	1.0323
Inyo	1.0323	Santa Clara	1.1761
Kern	1.0323	Santa Cruz	1.0323
Kings	1.0323	Shasta	1.0323
Lake	1.0323	Sierra	1.0323
Lassen	1.0323	Siskiyou	1.0323
Los Angeles	1.0753	Solano	1.1184
Madera	1.0323	Sonoma	1.0323
Marin	1.1184	Stanislaus	1.0323
Mariposa	1.0323	Sutter	1.0323
Mendocino	1.0323	Tehama	1.0323
Merced	1.0323	Trinity	1.0323
Modoc	1.0323	Tulare	1.0323
Mono	1.0323	Tuolumne	1.0323
Monterey	1.0323	Ventura	1.0903
Napa	1.1184	Yolo	1.0323
Nevada	1.0323	Yuba	1.0323

Source: Institute of Medicine, Physician Geographic Adjustment Factor Tables, GPCI Table 1B: Aggregate Geographic Adjustment Factors , by County, Col 2: "CY 2012 CMS w/out Frontier/AK Floor". http://www.iom.edu/reports/2012/geographic-adjustment-in-medicare-payment-phase-ii/tables.aspx.Accessed 3/17/2014.

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