2016 Estimated Health Care Expenditures of Chronic Disease in California

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Acknowledgements

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A. Executive Summary

The purpose of this study is to estimate medical expenditures in 2016 related to six common chronic conditions at the state and county levels in California.[1,2] These six chronic conditions are among diseases with the highest total medical expenditure in the United States (US).[1,2] The chronic conditions include diabetes, cardiovascular disease (CVD), arthritis, asthma, cancer, and depression. This study also estimated the medical expenditure for the four subcategories of CVD: i) hypertension, ii) coronary heart disease (CHD), iii) stroke, and iv) congestive heart failure (CHF). The 2016 medical expenditure estimates serve to update those from 2010.[3,4]

Follow-up investigation from the 2010 study identified the most recent prevalence of the six chronic conditions in November 2017 data from the California Health Interview Survey (CHIS) 2016[5]; the Surveillance Epidemiology and End Results (SEER) data (prevalence data in 2014)[6]; and the American Diabetes Association child prevalence data in 2012[7]. We estimated the annual per-person medical expenditure for subgroups defined by age, sex and race/ethnicity in 2016 while adjusting the expenditure data from the CDC Chronic Disease Cost Calculator[8] with the consumer price index (CPI) medical care component, i.e., adjusting original 2010 cost estimates to 2016 US dollar values[9]. When estimating the county level expenditure we used the 2016 population data[10,11] and adjusted geographic differences in medical care prices using Medicare geographic adjusters[12]. To estimate the total medical expenditure of each county, including acute diseases, we used the average annual per-person medical expenditure ($8,041 in 2016) while adjusting the 2014 estimate by the Centers for Medicare & Medicaid Services (CMS) with the CPI medical care component[9 13]. Unless otherwise specified, all expenditure and cost data were converted to 2016 US dollar values using the CPI medical care component[9]

Our study results show that in 2016 an estimated $141 billion was spent for the six common chronic conditions in California: arthritis; asthma; cancer; CVD; diabetes; and, depression demonstrating an increase from $98 billion in 2010[3,4]. During this six year period, the total state population increased by 5.5%[10,11] the medical care CPI increased by 19.4%[9], and the CMS's average annual per-person medical expenditure in California increased by 24%[9,13]. During the same six year period the California prevalence rates of the six chronic conditions increased as follows: arthritis (0.64 percentage points (pp)), asthma (0.69 pp), cancer (0.86 pp), CVD (2.74 pp), diabetes (0.77 pp), and depression (1.04 pp)[4]. The proportion percentage of total medical expenditures related to the six chronic conditions out of the total medical expenditures was approximately 45% at the state level in 2016 which was slightly higher than 42% in 2010[3]. This proportion varied substantially across counties with lowest counties being Kings at 34% and Kern at 35%, and highest counties being Calaveras at 67% and Sierra at 70%.

B. Background

The proportion of people having one or more chronic diseases was approximately 50% among all adults in the US in 2012[14]. Chronic diseases impose an annual burden on the US health care system and cost approximately $2.3 trillion or 86% of total US health care expenditures in 2010[2,15].

An earlier study reported that approximately $98 billion was spent for the six common chronic conditions in California in 2010[3,4]. The 2010 study of six chronic conditions were consistent with the conditions selected in a CDC study that estimated annual per-person medical expenditure[8]. These six chronic conditions included diabetes, CVD, arthritis, asthma, cancer, and depression. Except for cancer, five out of these six chronic conditions belonged to the conditions with an at least 10 percent prevalence rate among adults aged 18 years and older and costing approximately 60 billion dollars per condition in 2013 in the US[1]. The total medical expenditure for cancer including all age groups was estimated to be $144 billion in 2012 (expressed in 2014 dollar value)[16].

The importance of preventing chronic diseases is supported by national literature. For example, a US nationally representative data analysis indicated that nearly 10% of all hospital stays are potentially preventable[17]. Approximately 60% of these potentially preventable hospital stays were attributed to chronic conditions[17]. Preventive public health interventions that include promotion of physical activity and healthy diet could reduce the disease and financial impact of three principal chronic conditions of diabetes, CVD, and depression[18-21].

This study was conducted by a research team from the Division of Health Policy and Management in the Department of Public Health Sciences of the University of California Davis with guidance from the California Department of Public Health. Our study updated the earlier reports published in 2015[3,4] and followed the methodology developed by Professor P. M. Brown[3,4].

C. Methods

The Institutional Review Board (IRB) Administration at University of California, Davis reviewed this study's protocol and concluded our study was not research involving human subjects and therefore granted an exemption and a full IRB review was not required (IRB ID: 1104568-1).

We updated the 2010 cost estimates using general approaches following the earlier studies[3,4]. We estimated the medical expenditure related to the six common chronic conditions at the county level in California in 2016. These six chronic conditions included diabetes, CVD, arthritis, asthma, cancer, and depression. the study also estimated the medical expenditure for the four subcategories of CVD: i) hypertension (HTN), ii) coronary heart disease (CHD), iii) stroke, and iv) congestive heart failure (CHF).

To estimate the county level medical expenditures for each chronic condition or subcategory of CVD we multiplied four factors:
   (1) County level population as of 2016[10,11]
   (2) Prevalence of a specific chronic condition being unique to each of the subgroups defined by age, sex and race/ethnicity as of 2016 with some exceptions and summarized in Table 1[5-7]
   (3) Annual per-person medical expenditure for each of the subgroups as of 2016, and summarized in Table 2[8] while adjusting the original 2010 cost estimates to 2016 US dollar values with the CPI medical care component[9].

(4) Medicare geographic adjusters in 2016 to account for the geographic differences in medical care prices set by Centers for Medicare and Medicaid Services (CMS, and summarized in Appendix Table A1.[12]

To define the subgroups, we used five age categories (0-17, 18-44, 45-64, 65-79, and 80+) and five race/ethnicity categories (Hispanic, non-Hispanic White, non-Hispanic Asian, non-Hispanic Black, and non-Hispanic other). Due to limited national literature on the prevalence of arthritis and CVD among the youngest subgroup (age 0-17) we did not estimate the medical expenditures for arthritis and CVD among this subgroup (Table 1) following the example for age 0-17 in the previous study,.

Table 1 also includes the three data sources for the most recent prevalence data as of November 2017: the 2016 California Health Interview Survey (CHIS) for all chronic conditions except cancer and diabetes among children[5], the Surveillance Epidemiology and End Results (SEER) data for cancer (prevalence data in 2014)[6], and the American Diabetes Association for diabetes among children (child prevalence data in 2012)[7]. The CHIS is a state-representative population-based survey of non-institutionalized individuals in the state of California[5]. We estimated the prevalence for each subgroup at the state level while retrieving data from the online Web tool *AskCHIS*[22]. When the CHIS sample size for a subgroup was too small to estimate prevalence rates we combined the closest age categories within the same sex and race/ethnicity categories. When the CHIS sample size was still too small for a subgroup after aggregating age categories we combined with other race/ethnicity groups (other than the non-Hispanic white group) within the same sex category. Please note for arthritis and stroke that prevalence data from CHIS 2012 was the most recent year of CHIS data. The most recent depression data in CHIS were from 2012 for children and from 2016 for adults.

The cancer prevalence data in 2014 from the SEER were available only for each age and sex category without differentiating race/ethnicity categories[6]. The child diabetes prevalence data in 2012 from the American Diabetes Association indicated the same prevalence rate (0.25%) for all sex and race/ethnicity subgroups[7].

The annual per-person medical expenditure for each of the subgroups was derived from the online Web tool "CDC Chronic Disease Cost Calculator Version 2"[8]. This Web tool use was based on the analysis of nationally representative 2004-08 Medical Expenditure Panel Survey (MEPS) data to make cost estimates in 2010 dollar values. Unless otherwise specified in our study, all expenditure and cost data were converted to 2016 dollar values using the CPI medical care component[9]. An earlier study used the original cost estimates (in 2010 dollar value) by CDC without applying the CPI[3,4].

D. Results

Table 3 summarizes the state level medical expenditures of the six common chronic conditions. Approximately $141 billion was spent for medical expenditures related to these six conditions among 33 million disease cases in California in 2016. This amount was nearly 44.5% of the total medical expenditure in California. Among the six chronic conditions, CVD was estimated to have the largest number of cases (about 11.7 million) and the largest medical expenditure ($52 billion). It should be noted that the prevalence of CVD in Table 3 (39.1%) is likely to be overestimated, because an individual with both hypertension and stroke could be counted twice. Since the prevalence data from CHIS for stroke were not available for 2016, we were unable to estimate the prevalence of CVD accounting for such potential double counting for individuals with comorbidities.

The county level estimates are reported in Tables 4 and 5. In Los Angeles County the largest population is estimated at 10 million people[10,11] and approximately $37 billion was spent for medical expenditure due to these six chronic conditions. The proportion of total medical expenditures related to the six conditions out of the total medical expenditure varied substantially across counties with the lowest counties being Kings at 34% and Kern at 35%, and highest counties being Calaveras at 67% and Sierra at 70%.

E. Conclusions

The six common chronic conditions were estimated to incur nearly $141 billion in medical expenditures in California in 2016. These chronic conditions accounted for approximately 44.5% of the total medical expenditure in California. This proportion percentage varied markedly across counties with the lowest counties at approximately 34% and the highest counties at 67%-70%.

The estimated total medical expenditures related to the six chronic conditions increased from $98 billion in 2010[3,4] to $141 billion in 2016 which could be partly explained by: 1. increased population size, 2. increased price of medical care, and 3. changes in the prevalence rates of the chronic conditions between 2010 and 2016. During this six year period, the total state population increased by 5.5%[10,11], the medical care CPI increased by 19.4%[9], and the CMS's average annual per-person medical expenditure in California increased by 24%[13]. During the same period, the prevalence rates of the six conditions increased as follows: arthritis (0.64 percentage points (pp), i.e., increased from 19.36% to 20% in Table 3), asthma (0.69 pp, increased from 14.21% to 14.9%), cancer (0.86 pp, increased from 3.34% to 4.2%), CVD (2.74 pp, increased from 36.36% to 39.1%), diabetes (0.77 pp, increased from 6.18% to 6.95%), and depression (1.04 pp, increased from 11.66% to 12.7%)[4].

F. Discussion

The proportion percentage of total medical expenditure related to the six chronic conditions out of a total medical expenditure was approximately 45% at state level in 2016, and slightly higher than 42% in 2010[4]. The observed change in this percentage increase aligns with the prevalence rates increase for the six chronic conditions in the study.

Across-county variation in this percentage appears comparable between our estimates in 2016 and previous estimates in 2010. Specifically, the two counties of Kern and Kings were the lowest among 58 counties both in 2010 and 2016. Correspondingly, the ten counties with the highest percentages were highly overlapping between 2010 and 2016 estimates[3]. The across-county variation in this proportion was explained by the differences in demographic factors: such as, proportions of older populations and those of certain race/ethnic subgroups among a total county population. Table 2 indicates the per-person annual medical expenditure tended to be higher among older age subgroups, and particularly females aged 65+ than younger age subgroups. The Hispanic population had the highest diabetes prevalence rates within all subgroups defined by age and sex.

Appendix Table A2 supported our explanations above. Kern and Kings Counties were among the three counties with the lowest proportions of (a) age 65 and older and (b) female age 65 and older in a total county population, i.e., Kern at (a) 10.6% and (b) 5.8%, and Kings at (a) 10.0% and (b) 5.5%. Calaveras and Sierra counties were among the three counties with the highest proportions, i.e., Calaveras at (a) 27.6% and (b) 14.1%, and Sierra at (a) 29.0% and (b) 14.4%. The state average for these proportions were: (a) 13.9% and (b) 7.7%.

Counties with a higher proportion of the Hispanic population were expected to have a higher total expenditure for diabetes due to a higher diabetes prevalence rate among the Hispanic population. Since these counties contained a lower proportions of an older population they tended to be lower in the proportion of the total medical expenditure related to the six chronic conditions out of the total county medical expenditure.

G. Limitations

Our study's limitations are related to the limits of the prevalence data and the cost data used. The prevalence rate data were not available for some subgroups due to small sizes. This study's medical expenditure estimates adjusted the cost data derived from the CDC cost calculator (based on the 2004-2008 MEPS data analysis)[8] with the medical care CPI, which may not adequately capture the changes in the medical expenditure after 2008. Because the CDC cost calculator provides the most comprehensive expenditure data needed for the study's research goals among all available databases our approach with the CPI adjustment appears reasonable. The use of the CDC cost calculator enables this study to be easily compared with an earlier study[3,4] that shared the same general approaches including the use of the CDC cost calculator.

H. Future Considerations

Our study's empirical findings are expected to help inform counties about their community health assessment (CHA) and community health improvement planning (CHIP). A higher proportion of a specific chronic condition among total county medical expenditures unique to each county would help justify a future public health intervention targeting the specific chronic condition in the county. At state level, this study's findings and earlier estimates in 2010 allow the public, state and local officials to better understand the cost burden of chronic diseases

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TABLE 1: Prevalence Rates of Chronic Diseases in California

	Age Range, y	Measure	Rate for California
Arthritis	0-17	Not available	Not available
	18 and older	Ever diagnosed with arthritis, gout, lupus, or fibromyalgia (AskCHIS[a])	20.0%
Asthma	0-17	Ever diagnosed with asthma (AskCHIS[a])	16.8%
	18 and older	Ever diagnosed with asthma (AskCHIS[a])	14.3%
Cancer	0-17	SEER Stat and 2009 and 2010 SEER[b]	0.1%
	18 and older	SEER Stat and 2009 and 2010 SEER	4.7%
Cardiovascular disease	0-17	Not available	Not available
CHF	18 and older	Ever told have heart failure/CHF (AskCHIS[a])	1.80%
CHD	18 and older	Ever diagnosed with heart disease (AskCHIS[a])	6.3%
Hypertension	18 and older	Ever diagnosed with high blood pressure (AskCHIS[a])	28.7%
Stroke	18 and older	Ever had a stroke (AskCHIS[a])	2.3%
Other heart diseases	18 and older	Not available	Not available
Depression	0-17	Likely has had frequent mental distress during past month (AskCHIS[a])	9.8%
	18 and older	Saw health professional for emotional/mental and/or alcohol-drug issues in past year (AskCHIS[a])	13.4%
Diabetes	0-17	Diabetes prevalence (ADA[c])	0.2%
	18 and older	Ever diagnosed with diabetes (AskCHIS[a])	9.0%

Abbreviations: ADA, American Diabetes Association; CC, Clinical Classification; CDC, Centers for Disease Control and Prevention; CHD, coronary heart disease; CHF, congestive heart failure; ICD-9, International Classification of Diseases, Ninth Revision; SEER, Surveillance, Epidemiology, and End Results.
[a]From the California Health Interview Survey (prevalence data in 2016)..[6,22]
[b]From Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database (prevalence data in 2014).[9]
[c]From the American Diabetes Association (prevalence data in 20

TABLE 2: Cost of Chronic Conditions in California by Clinical Classification ICD (CC/ICD-9) CC/ICD-9: (2016 US dollars)[8,9]

	CC and ICD-9 Codes[b]	Male Age 0-17 y	Male Age 18-44 y	Male Age 45-64 y	Male Age 65-79 y	Male Age 80+ y	Female Age 0-17 y	Female Age 18-44 y	Female Age 45-64 y	Female Age 65-79 y	Female Age 80+ y
Arthritis	ICD-9: 274, 354, 390, 391, 443, 446, 710-716, 719-721, 725-729	$1,003	$1,417	$2,184	$3,919	$4,336	$978	$1,564	$2,330	$3,863	$5,486
Cancer	CC: 11-43, 45	$2,965	$4,454	$8,303	$13,728	$16,066	$3,629	$4,670	$8,634	$14,851	$20,153
Hypertension	ICD-9: 401-405	$0	$1,080	$1,472	$2,540	$3,791	$729	$1,163	$1,552	$2,626	$5,485
Stroke	ICD-9: 430-434, 436-438	$2,009	$5,099	$10,564	$15,153	$18,931	$2,828	$5,582	$10,659	$17,816	$30,261
Diabetes	ICD-9: 250	$1,896	$2,852	$4,441	$7,646	$11,742	$2,030	$3,482	$5,092	$8,772	$16,101

[a]Source: the Centers for Disease Control and Prevention's Chronic Disease Cost Calculator Version 2a[8] with the consumer price index.[9]; [b]CC code and 3-digit ICD-9 code from http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp using responses from the Medical Expenditure Panel Survey from 2004 to 2008. Abbreviations: CHD, coronary heart disease; CHF, congestive heart failure; CC, Clinical Classification; ICD-9, International Classification of Diseases, Ninth Revision.

TABLE 3: Summary of the Number of Cases and Costs of Chronic Conditions in California in 2016

Conditions	No. Cases[a]	% Total Population[b]	Medical Expenditure of 6 Chronic Conditions[c] [million dollars]	% Total Medical Expenditure
Arthritis	6,007,903	20.0[d]	$19,614	6.20%
Asthma	5,863,456	14.9	$13,300	4.20%
Cancer	1,643,538	4.2	$22,264	7.04%
Cardiovascular disease (CVD) total (=HT+CHD+CHF+Stroke)	11,777,775	n/a	$51,906	16.40%
Hypertension (HT)	8,622,996	28.7[d]	$18,886	5.97%
CHD	1,897,433	6.3[d]	$15,897	5.02%
Stroke	704,985	2.3[d]	$12,147	3.84%
CHF	552,361	1.8[d]	$4,976	1.57%
Diabetes	2,734,163	6.95	$18,861	5.96%
Depression	4,982,845	12.7	$14,805	4.68%
Total	33,009,680		$140,751	44.48%

CHD, coronary heart disease; CHF, congestive heart failure
[a]Estimated total number of people with this condition in California from *AskCHIS* online web tool.[22] Of note, for arthritis and stroke, 2012 was the most recent data. Concerning the depression prevalence data in CHIS, the most recent data was 2012 among children and 2016 among adults.
[b]Estimated total number of cases divided by the total population of California in 2016.[10,11]
[c]Estimated cost for each chronic condition in California.
[d]Estimated total number of cases divided by the adult total population of California.

TABLE 4: Cost of Chronic Conditions—By Population in California in 2016

County	Population	Arthritis	Asthma	Cancer	Depression	Diabetes
Alameda	1,637,712	$849,519,589	$596,044,475	$950,253,153	$643,308,101	$770,865,020
Alpine	1,148	$878,010	$453,601	$952,726	$522,681	$622,350
Amador	37,191	$29,413,499	$15,423,921	$34,469,959	$17,552,224	$22,898,272
Butte	225,125	$132,365,941	$81,550,331	$148,301,758	$97,259,195	$101,588,739
Calaveras	44,791	$36,669,839	$19,089,583	$43,062,363	$21,769,570	$28,505,770
Colusa	22,408	$10,504,455	$6,941,229	$12,050,375	$7,743,315	$10,787,811
Contra Costa	1,129,894	$608,950,801	$394,412,986	$678,308,787	$438,120,324	$529,126,826
Del Norte	27,040	$16,147,051	$9,699,632	$17,747,318	$11,204,505	$12,561,964
El dorado	184,180	$120,144,365	$70,601,676	$134,147,310	$83,819,752	$92,563,250
Fresno	989,183	$403,317,616	$293,980,263	$457,339,113	$326,154,532	$422,225,596
Glenn	29,073	$14,812,756	$9,551,302	$16,901,277	$11,012,031	$13,392,487
Humboldt	136,086	$78,405,574	$49,251,689	$84,463,358	$59,405,315	$57,601,376
Imperial	187,157	$74,951,866	$51,778,017	$90,423,553	$55,509,784	$101,547,693
Inyo	18,649	$13,300,876	$7,144,458	$15,354,294	$8,067,215	$10,618,221
Kern	888,994	$346,141,844	$261,531,679	$377,323,325	$295,000,620	$348,579,888
Kings	149,407	$53,670,228	$42,069,366	$59,651,060	$46,922,577	$56,734,694
Lake County	65,128	$44,409,769	$25,033,827	$50,386,490	$28,946,169	$34,902,814
Lassen	30,645	$16,850,189	$10,620,297	$18,150,027	$12,496,625	$13,202,876
Los Angeles	10,229,245	$4,968,922,241	$3,406,685,306	$5,693,337,952	$3,685,832,949	$5,278,368,004
Madera	155,693	$71,401,652	$48,343,923	$81,653,627	$53,625,781	$71,590,593
Marin	263,257	$199,341,784	$112,737,174	$226,861,113	$129,530,179	$155,677,578
Mariposa	18,055	$14,738,517	$7,611,991	$17,304,995	$8,752,471	$11,319,048
Mendocino	88,995	$57,093,252	$33,299,423	$64,156,121	$38,030,554	$45,277,947
Merced	272,610	$104,565,390	$78,688,090	$117,392,824	$87,531,032	$112,363,925
Modoc	9,469	$7,088,871	$3,808,512	$8,244,536	$4,334,048	$5,514,550
Mono	13,785	$6,641,495	$4,684,290	$6,668,099	$5,672,143	$5,308,097
Monterey	441,129	$194,972,531	$133,779,650	$224,378,137	$147,371,819	$202,435,291
Napa	142,269	$91,340,174	$55,256,589	$105,007,375	$62,895,964	$79,790,783
Nevada	98,552	$77,167,993	$41,190,179	$89,318,520	$47,910,556	$58,036,497
Orange	3,181,371	$1,663,265,495	$1,126,303,727	$1,914,539,816	$1,270,697,368	$1,572,462,201
Placer	376,092	$237,858,722	$141,467,986	$269,714,094	$167,135,181	$185,382,274
Plumas	19,494	$15,953,026	$8,332,471	$18,541,207	$9,465,329	$12,070,572

County	Population	Arthritis	Asthma	Cancer	Depression	Diabetes
Riverside	2,360,727	$1,135,748,764	$753,950,906	$1,293,889,269	$837,023,937	$1,108,364,936
Sacramento	1,506,677	$727,332,776	$502,751,008	$790,263,095	$569,772,467	$616,732,833
San Benito	58,014	$26,283,027	$17,844,448	$29,416,912	$20,457,269	$28,158,652
San Bernardino	2,147,933	$879,442,723	$646,060,895	$956,621,518	$717,259,540	$908,666,504
San Diego	3,300,891	$1,584,060,385	$1,077,086,391	$1,780,167,173	$1,229,252,015	$1,448,844,145
San Francisco	871,185	$515,153,830	$352,182,532	$618,763,201	$393,013,817	$471,586,299
San Joaquin	738,873	$321,063,202	$230,477,989	$356,029,565	$254,206,224	$311,705,539
San Luis Obispo	278,917	$176,100,093	$103,499,337	$200,975,341	$121,443,668	$142,770,013
San Mateo	768,122	$469,213,254	$304,477,668	$548,963,654	$334,672,498	$433,369,710
Santa Barbara	448,353	$219,466,809	$144,118,986	$251,491,345	$166,181,949	$206,536,788
Santa Clara	1,930,215	$1,000,543,548	$713,964,524	$1,179,099,043	$781,895,357	$969,175,309
Santa Cruz	276,249	$143,339,070	$93,627,078	$157,131,308	$110,296,885	$124,221,025
Shasta County	178,208	$115,849,296	$67,976,763	$129,149,278	$80,834,563	$86,008,286
Sierra County	3,140	$2,691,830	$1,369,359	$3,142,994	$1,574,011	$2,067,067
Siskiyou	44,372	$33,206,858	$17,897,821	$38,204,913	$20,504,760	$25,303,404
Solano	434,102	$247,813,809	$163,409,703	$273,460,049	$176,916,057	$217,609,390
Sonoma	503,953	$310,474,580	$185,414,745	$346,412,626	$216,194,935	$251,326,112
Stanislaus	545,008	$244,062,120	$170,320,704	$268,515,190	$195,847,620	$230,558,891
Sutter	98,191	$47,795,138	$32,383,638	$54,908,868	$36,811,920	$43,052,929
Tehama	64,098	$38,444,249	$23,093,979	$43,545,334	$26,946,587	$30,786,955
Trinity	13,482	$10,971,392	$5,693,790	$12,707,207	$6,498,526	$8,285,337
Tulare	468,235	$182,100,175	$134,628,653	$206,340,760	$149,754,994	$199,111,613
Tuolumne	54,282	$42,216,615	$22,357,554	$49,334,258	$25,747,127	$32,414,394
Ventura	854,383	$453,735,576	$295,904,344	$512,539,121	$339,935,066	$428,825,950
Yolo	216,866	$92,568,953	$68,058,764	$101,281,013	$80,081,973	$83,271,300
Yuba	76,129	$33,465,986	$24,213,361	$35,719,554	$28,489,097	$27,987,452
Total for California	39,354,432	$19,613,949,471	$13,300,132,582	$22,264,477,249	$14,805,212,773	$18,860,663,837

TABLE 4: Cost of Chronic Conditions−By County in California in 2016 [continued]

County	Population	All 4 Sub-categories Combined	Hypertension	CHD	Stroke	CHF
Alameda	1,637,712	$2,246,256,590	$834,603,760	$678,208,868	$520,810,444	$212,633,518
Alpine	1,148	$2,023,825	$706,735	$662,132	$469,683	$185,274
Amador	37,191	$74,868,625	$24,439,731	$24,490,639	$18,252,702	$7,685,553
Butte	225,125	$332,038,072	$112,865,713	$105,899,027	$80,452,796	$32,820,536
Calaveras	44,791	$92,092,727	$29,858,938	$30,284,132	$22,410,551	$9,539,106
Colusa	22,408	$27,627,674	$9,916,612	$8,600,811	$6,421,294	$2,688,957
Contra Costa	1,129,894	$1,560,447,488	$559,163,369	$485,155,847	$364,576,423	$151,551,848
Del Norte	27,040	$39,914,565	$13,671,150	$12,819,481	$9,439,305	$3,984,629
El dorado	184,180	$295,279,784	$99,611,441	$96,622,004	$69,060,642	$29,985,697
Fresno	989,183	$1,078,334,305	$398,325,398	$327,820,146	$250,033,332	$102,155,428
Glenn	29,073	$38,162,527	$13,308,565	$12,068,976	$9,022,111	$3,762,876
Humboldt	136,086	$189,993,469	$65,285,192	$61,309,945	$44,555,173	$18,843,159
Imperial	187,157	$214,914,226	$80,740,710	$62,866,725	$51,189,773	$20,117,018
Inyo	18,649	$33,672,950	$11,222,276	$10,719,181	$8,288,889	$3,442,604
Kern	888,994	$896,236,071	$334,046,640	$276,599,127	$200,811,016	$84,779,288
Kings	149,407	$143,953,570	$54,204,851	$43,636,493	$32,593,257	$13,518,968
Lake County	65,128	$110,401,054	$36,917,970	$35,786,185	$26,481,951	$11,214,948
Lassen	30,645	$41,808,698	$14,744,673	$13,523,832	$9,412,059	$4,128,134
Los Angeles	10,229,245	$13,491,569,127	$5,036,086,509	$4,033,253,589	$3,149,860,965	$1,272,368,065
Madera	155,693	$187,065,319	$66,851,541	$58,176,656	$43,931,639	$18,105,484
Marin	263,257	$499,987,908	$167,159,124	$161,971,158	$120,412,442	$50,445,185
Mariposa	18,055	$37,113,154	$12,101,651	$12,078,233	$9,092,212	$3,841,059
Mendocino	88,995	$141,590,052	$47,681,008	$46,091,253	$33,526,206	$14,291,584
Merced	272,610	$278,590,983	$104,018,904	$84,782,664	$63,524,353	$26,265,063
Modoc	9,469	$17,790,112	$5,841,256	$5,809,805	$4,306,188	$1,832,863
Mono	13,785	$15,280,492	$5,581,381	$5,135,411	$3,028,558	$1,535,141
Monterey	441,129	$525,846,855	$191,303,956	$160,579,709	$123,709,948	$50,253,242
Napa	142,269	$236,317,584	$81,534,372	$74,709,281	$56,665,673	$23,408,258
Nevada	98,552	$192,764,085	$62,712,221	$63,240,935	$47,021,784	$19,789,145
Orange	3,181,371	$4,443,510,669	$1,600,487,696	$1,369,311,368	$1,045,398,274	$428,313,331
Placer	376,092	$599,128,789	$202,482,914	$191,988,654	$144,835,150	$59,822,071
Plumas	19,494	$39,671,951	$12,843,823	$13,134,817	$9,594,319	$4,098,992

County	Population	All 4 Sub-categories Combined	Hypertension	CHD	Stroke	CHF
Riverside	2,360,727	$2,985,680,769	$1,071,308,012	$923,012,155	$702,949,308	$288,411,294
Sacramento	1,506,677	$1,844,380,414	$669,879,264	$569,454,254	$428,793,999	$176,252,897
San Benito	58,014	$68,876,960	$25,308,068	$21,237,935	$15,693,715	$6,637,241
San Bernardino	2,147,933	$2,280,451,018	$858,591,993	$695,165,322	$512,035,517	$214,658,186
San Diego	3,300,891	$4,130,581,506	$1,487,860,615	$1,276,613,126	$968,665,088	$397,442,677
San Francisco	871,185	$1,458,767,515	$535,079,114	$432,726,335	$352,162,785	$138,799,280
San Joaquin	738,873	$838,893,860	$310,584,098	$256,621,086	$191,857,730	$79,830,947
San Luis Obispo	278,917	$446,943,387	$151,355,415	$143,320,911	$107,536,431	$44,730,630
San Mateo	768,122	$1,265,176,981	$453,215,153	$387,740,146	$301,631,843	$122,589,839
Santa Barbara	448,353	$580,297,580	$205,760,039	$179,086,026	$139,486,478	$55,965,036
Santa Clara	1,930,215	$2,767,781,107	$1,012,818,701	$840,353,996	$650,112,469	$264,495,940
Santa Cruz	276,249	$359,233,916	$126,869,554	$114,673,365	$82,442,590	$35,248,407
Shasta County	178,208	$284,782,536	$95,291,802	$92,363,453	$68,449,625	$28,677,657
Sierra County	3,140	$6,691,470	$2,169,621	$2,230,850	$1,603,276	$687,722
Siskiyou	44,372	$82,957,113	$27,218,492	$26,959,625	$20,280,227	$8,498,769
Solano	434,102	$635,368,213	$232,241,279	$194,557,385	$147,388,104	$61,181,445
Sonoma	503,953	$776,100,726	$265,423,223	$249,316,390	$184,229,367	$77,131,747
Stanislaus	545,008	$626,189,437	$227,059,485	$194,249,007	$144,888,899	$59,992,047
Sutter	98,191	$125,940,739	$44,749,410	$39,056,495	$29,894,918	$12,239,915
Tehama	64,098	$96,442,192	$32,547,446	$31,042,828	$23,211,548	$9,640,370
Trinity	13,482	$27,265,785	$8,914,971	$8,956,392	$6,577,622	$2,816,800
Tulare	468,235	$485,392,528	$179,189,438	$148,704,815	$111,392,764	$46,105,511
Tuolumne	54,282	$107,004,645	$34,965,170	$34,736,215	$26,353,534	$10,949,726
Ventura	854,383	$1,180,261,472	$421,169,734	$367,926,199	$276,427,928	$114,737,611
Yolo	216,866	$237,759,062	$86,861,656	$73,605,333	$54,766,060	$22,526,012
Yuba	76,129	$82,682,219	$29,743,157	$26,203,071	$18,735,116	$8,000,875
Total for California	39,354,432	$51,906,156,448	$18,886,494,994	$15,897,249,798	$12,146,756,050	$4,975,655,605

TABLE 5: Proportion of Total Health Care Expenditure Related to the Six Chronic Conditions Among Total Health Care Expenditure by County in California in 2016[9,13]

County	Medical Expenditure of 6	Total Medical	% Total Medical
Alameda	$6,056,246,927	$13,169,216,931	46.0%
Alpine	$5,453,192	$9,231,331	59.1%
Amador	$194,626,500	$299,061,341	65.1%
Butte	$893,104,036	$1,810,281,638	49.3%
Calaveras	$241,189,853	$360,174,680	67.0%
Colusa	$75,654,859	$180,187,855	42.0%
Contra Costa	$4,209,367,212	$9,085,736,195	46.3%
Del Norte	$107,275,034	$217,434,827	49.3%
El dorado	$796,556,138	$1,481,033,524	53.8%
Fresno	$2,981,351,425	$7,954,246,847	37.5%
Glenn	$103,832,380	$233,782,645	44.4%
Humboldt	$519,120,781	$1,094,298,665	47.4%
Imperial	$589,125,140	$1,504,972,262	39.1%
Inyo	$88,158,015	$149,960,876	58.8%
Kern	$2,524,813,427	$7,148,604,173	35.3%
Kings	$403,001,494	$1,201,415,874	33.5%
Lake County	$294,080,122	$523,709,151	56.2%
Lassen	$113,128,713	$246,423,457	45.9%
Los Angeles	$36,524,715,580	$82,255,699,689	44.4%
Madera	$513,680,895	$1,251,963,038	41.0%
Marin	$1,324,135,738	$2,116,909,775	62.6%
Mariposa	$96,840,177	$145,184,386	66.7%
Mendocino	$379,447,350	$715,629,159	53.0%
Merced	$779,132,243	$2,192,119,388	35.5%
Modoc	$46,780,630	$76,142,396	61.4%
Mono	$44,254,615	$110,848,339	39.9%
Monterey	$1,428,784,283	$3,547,219,228	40.3%
Napa	$630,608,467	$1,144,017,583	55.1%
Nevada	$506,387,829	$792,479,183	63.9%
Orange	$11,990,779,277	$25,582,132,169	46.9%

County	Medical Expenditure of 6	Total Medical	% Total Medical
Placer	$1,600,687,046	$3,024,241,829	52.9%
Plumas	$104,034,556	$156,755,715	66.4%
Riverside	$8,114,658,581	$18,983,145,986	42.7%
Sacramento	$5,051,232,593	$12,115,534,513	41.7%
San Benito	$191,037,267	$466,503,849	41.0%
San Bernardino	$6,388,502,197	$17,272,020,740	37.0%
San Diego	$11,249,991,615	$26,543,219,837	42.4%
San Francisco	$3,809,467,194	$7,005,397,929	54.4%
San Joaquin	$2,312,376,379	$5,941,446,861	38.9%
San Luis Obispo	$1,191,731,837	$2,242,835,418	53.1%
San Mateo	$3,355,873,765	$6,176,644,763	54.3%
Santa Barbara	$1,568,093,457	$3,605,309,065	43.5%
Santa Clara	$7,412,458,887	$15,521,300,485	47.8%
Santa Cruz	$987,849,282	$2,221,381,420	44.5%
Shasta County	$764,600,722	$1,433,011,305	53.4%
Sierra County	$17,536,731	$25,249,458	69.5%
Siskiyou	$218,074,868	$356,805,405	61.1%
Solano	$1,714,577,222	$3,490,713,513	49.1%
Sonoma	$2,085,923,723	$4,052,401,387	51.5%
Stanislaus	$1,735,493,964	$4,382,534,036	39.6%
Sutter	$340,893,230	$789,576,299	43.2%
Tehama	$259,259,296	$515,426,685	50.3%
Trinity	$71,422,038	$108,411,847	65.9%
Tulare	$1,357,328,722	$3,765,184,776	36.0%
Tuolumne	$279,074,592	$436,493,983	63.9%
Ventura	$3,211,201,528	$6,870,289,202	46.7%
Yolo	$663,021,064	$1,743,869,129	38.0%
Yuba	$232,557,669	$612,170,709	38.0%
Total for California	$140,750,592,359	$316,457,992,747	44.5%

[a]Based on the original estimates reported in TABLE 4.
[b]Based on the average annual per-person medical expenditure ($8,041 in 2016), adjusting the 2014 estimate by Centers for Medicare & Medicaid Services (CMS) with the CPI medical care component.[9,13]

APPENDIX TABLE A1: Geographic Adjustment Factors for Counties in California in 2016[12]

Geographic adjustment factors	County
1.035	All other counties (Alpine, Amador, Butte, Calaveras, Colusa, Contra Costa, Del Norte, El Dorado, Fresno, Glenn, Humboldt, Imperial, Inyo, Kern, Kings, Lake County, Lassen, Madera, Mariposa, Mendocino, Merced, Modoc, Mono, Monterey, Nevada, Placer, Plumas, Riverside, Sacramento, San Benito, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Shasta County, Sierra County, Siskiyou, Sonoma, Stanislaus, Sutter, Tehama, Trinity, Tulare, Tuolumne, Yolo, Yuba)
1.088	Ventura
1.091	Los Angeles
1.109	Orange
1.135	Marin, Napa, Solano
1.173	Santa Clara
1.180	San Mateo
1.188	San Francisco
1.123	Alameda

APPENDIX TABLE A2: Proportions of an Age Group (aged 65 or older) and Hispanic Group in Total County Population in California (58 counties) in 2016[10,11]

County	Total population	Proportion of age 65 and older [%] (Rank: 1=lowest)	Proportion of female and age 65 and older [%] (Rank: 1=lowest)	Hispanic population [%] (Rank: 1=lowest)
Alameda	1,637,712	13.6% (18)	7.6% (19)	23.3% (25)
Alpine	1,148	23.0% (48)	11.3% (46)	7.4% (1)
Amador	37,191	26.3% (53)	13.8% (55)	13.0% (12)
Butte	225,125	18.0% (36)	10.1% (38)	15.3% (16)
Calaveras	44,791	27.6% (56)	14.1% (57)	10.9% (9)
Colusa	22,408	14.1% (21)	7.4% (15)	57.3% (54)
Contra Costa	1,129,894	15.5% (30)	8.7% (31)	25.3% (28)
Del Norte	27,040	17.7% (35)	9.4% (35)	17.4% (20)
El dorado	184,180	19.7% (41)	10.2% (39)	13.2% (13)
Fresno	989,183	11.7% (6)	6.5% (8)	52.5% (50)
Glenn	29,073	15.3% (29)	8.0% (26)	39.7% (41)
Humboldt	136,086	16.7% (34)	9.0% (33)	10.8% (8)
Imperial	187,157	12.1% (9)	6.8% (10)	81.9% (58)
Inyo	18,649	22.6% (47)	11.6% (47)	20.9% (22)
Kern	888,994	10.6% (2)	5.8% (2)	51.7% (49)
Kings	149,407	10.0% (1)	5.5% (1)	53.3% (51)
Lake County	65,128	21.5% (46)	11.2% (45)	18.8% (21)
Lassen	30,645	15.5% (30)	7.8% (22)	17.1% (19)
Los Angeles	10,229,245	13.2% (15)	7.5% (17)	49.4% (47)
Madera	155,693	13.7% (19)	7.4% (15)	57.0% (52)
Marin	263,257	21.4% (45)	11.8% (48)	16.8% (18)
Mariposa	18,055	27.1% (54)	13.7% (54)	9.9% (7)
Mendocino	88,995	20.3% (44)	10.9% (44)	24.0% (27)
Merced	272,610	10.8% (3)	5.9% (3)	57.2% (53)
Modoc	9,469	24.8% (50)	12.7% (49)	14.8% (15)
Mono	13,785	12.7% (13)	5.9% (3)	27.7% (34)
Monterey	441,129	13.0% (14)	7.1% (14)	58.0% (55)
Napa	142,269	18.0% (36)	9.8% (36)	34.5% (38)
Nevada	98,552	25.7% (51)	13.6% (53)	9.4% (6)
Orange	3,181,371	14.2% (23)	7.9% (24)	35.3% (40)
Placer	376,092	19.4% (40)	10.7% (42)	13.6% (14)
Plumas	19,494	27.7% (57)	14.0% (56)	8.8% (3)
Riverside	2,360,727	14.1% (21)	7.8% (22)	47.3% (46)
Sacramento	1,506,677	13.3% (16)	7.6% (19)	22.8% (24)
San Benito	58,014	12.6% (12)	6.8% (10)	58.2% (56)

County	Total population	Proportion of age 65 and older [%] (Rank: 1=lowest)	Proportion of female and age 65 and older [%] (Rank: 1=lowest)	Hispanic population [%] (Rank: 1=lowest)
San Bernardino	2,147,933	11.0% (4)	6.1% (5)	51.1% (48)
San Diego	3,300,891	13.8% (20)	7.7% (21)	33.8% (37)
San Francisco	871,185	15.9% (32)	8.7% (31)	15.4% (17)
San Joaquin	738,873	12.2% (10)	6.8% (10)	40.6% (42)
San Luis Obispo	278,917	19.7% (41)	10.6% (41)	22.5% (23)
San Mateo	768,122	16.1% (33)	9.1% (34)	26.1% (30)
Santa Barbara	448,353	14.4% (24)	8.0% (26)	45.6% (45)
Santa Clara	1,930,215	13.5% (17)	7.5% (17)	27.5% (33)
Santa Cruz	276,249	14.9% (27)	8.0% (26)	34.6% (39)
Shasta County	178,208	19.9% (43)	10.8% (43)	9.2% (5)
Sierra County	3,140	29.0% (58)	14.4% (58)	8.9% (4)
Siskiyou	44,372	24.4% (49)	12.7% (49)	11.4% (11)
Solano	434,102	14.9% (27)	8.3% (30)	25.6% (29)
Sonoma	503,953	18.5% (38)	10.3% (40)	26.4% (31)
Stanislaus	545,008	12.5% (11)	7.0% (13)	44.6% (44)
Sutter	98,191	14.5% (25)	7.9% (24)	30.7% (35)
Tehama	64,098	18.5% (38)	9.9% (37)	23.7% (26)
Trinity	13,482	27.1% (54)	13.2% (51)	7.6% (2)
Tulare	468,235	11.2% (5)	6.1% (5)	63.1% (57)
Tuolumne	54,282	25.7% (51)	13.5% (52)	11.0% (10)
Ventura	854,383	14.6% (26)	8.0% (26)	42.6% (43)
Yolo	216,866	11.9% (7)	6.6% (9)	31.4% (36)
Yuba	76,129	12.0% (8)	6.4% (7)	26.7% (32)
Total for California	39,354,432	13.9%	7.7%	39.2%