Cost of Chronic Disease in California: Estimates at the County Level

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Context: An estimated 39% of people in California suffer from at least one chronic condition or disease. While the increased coverage provided by the Affordable Care Act will result in greater access to primary health care, coordinated strategies are needed to prevent chronic conditions. To identify cost-effective strategies, local health departments and other agencies need accurate information on the costs of chronic conditions in their region. **Objective:** To present a methodology for estimating the cost of chronic conditions for counties. **Methods:** Estimates of the attributable cost of 6 chronic conditions—arthritis, asthma, cancer, cardiovascular disease, diabetes, and depression—from the Centers for Disease Control and Prevention's Chronic Disease Cost Calculator were combined with prevalence rates from the various sources and census data for California counties to estimate the number of cases and costs of each condition. The estimates were adjusted for differences in prices using Medicare geographical adjusters. **Results:** An estimated $98 billion is currently spent on treating chronic conditions in California. There is significant variation between counties in the percentage of total health care expenditure due to chronic conditions and county size, ranging from a low 32% to a high of 63%. The variations between counties result from differing rates of chronic conditions across age, ethnicity, and gender.

Conclusions: Information on the cost of chronic conditions is important for planning prevention and control efforts. This study demonstrates a method for providing local health departments with estimates of the scope of the problems in their region. Combining the cost estimates with information on current prevention strategies can identify gaps in prevention activities and the prevention measures that promise the greatest return on investment for each county.

Recent evidence suggests that more than half of Americans suffer from 1 or more chronic diseases, with the estimated cost of treating these conditions exceeding $1 trillion annually.[1] Unless preventative measures are taken, the rate of chronic diseases is expected to increase annually and with it the cost of treatment. By 2050, it is estimated that treatment costs will exceed $6 trillion.[1] California will be significantly impacted by the projected growth of chronic diseases in the United States, as it has the largest population of all US states. Currently, in California, there are an estimated 14 million people living with at least one chronic condition and more than half of this group have multiple chronic conditions.[2]

The advent of the Affordable Care Act 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 vulnerable and at-risk populations. Reducing the rates of chronic conditions and their associated costs will require a concerted and coordinated effort that integrates all levels of government, private providers, and the public to address issues such as poor nutrition, tobacco use, excessive alcohol use, and lack of physical activity.

Information on the cost of chronic conditions to counties can help community members understand the scope of the problems facing the people in their region and identify high priority areas to target interventions and programs. As the primary organization responsible for monitoring the health of the people in the region, local health departments (LHDs) are expected to play an increasingly important role in combating the spread of chronic diseases in the future.[3] Accurate estimates of the rates and costs of chronic conditions can help LHDs identify the amount of health care expenditure that could be saved if chronic conditions were prevented or controlled, information that is vital to identifying and planning cost-effective prevention and control efforts.

The goal of a costing study is to report only the costs associated with a condition (the "attributable" or "marginal" costs).[4] Estimating the attributable cost of care for a particular condition requires differentiating between those costs that are incurred because of a specific condition and those that are incurred for other reasons. From the standpoint of identifying and planning prevention activities, the attributable costs are more relevant than the total costs since they provide an estimate of the amount of health care expenses that could be saved by avoiding a particular condition. This study combines estimates from the Centers for Disease Control and Prevention's (CDC's) Chronic Disease Cost Calculator,[5] with county-level data on rates of 6 chronic conditions and attributable cost of each condition to estimate the burden of chronic conditions in each county.

● Methods

The methodology involved the following steps:

1. Use the CDC's Chronic Disease Cost Calculator to develop estimates of the additional medical expenditure (cost) associated with chronic conditions for the state of California by condition, age group, and gender.
2. Develop a cost per case of each of the chronic conditions in each county of California by adjusting for price differences in health care services between counties.
3. Estimate the prevalence of chronic disease within each county of California by age, gender, and race/ethnicity. We used 5 age strata (0-17, 18-44, 45-64, 64-79, and ≥80 years), 2 gender categories (male and female), and 5 race/ethnicity categories (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and non-Hispanic other).
4. Combine estimates for the rates of chronic conditions with county-level census population data (by age strata, gender, and ethnicity) to form estimates for the number of cases of chronic conditions in that county.
5. Estimate the total additional cost of each chronic condition in each county by multiplying and then adding the cost per case of each chronic condition in that county by the number of cases for each of the 6 chronic conditions in that county.

The research was provided an exemption from the institutional review board at the University of California, Merced.

Data sources
Cost estimates from the CDC Chronic Disease Cost Calculator

Estimates of the medical payments attributable to each chronic condition were estimated using the *CDC Chronic Disease Cost Calculator, Version 2* (referred to as the CDC Cost Calculator).[5] The CDC Cost Calculator provides state-level estimates of medical payments for arthritis, asthma, cancer, cardiovascular diseases (CVDs), depression, and diabetes by age group and gender. Because CVD is such a broad category, when estimating CVD, the CDC calculated costs of congestive heart failure (CHF), coronary heart disease (CHD), hypertension, stroke, and other heart diseases separately. The estimates are provided by gender for 5 age bands or strata: (1) 0 to 17, (2) 18 to 44, (3) 45 to 64, (4) 65 to 79, and (5) 80 years or older. All information used in this report is publically available from the CDC, including tables of the cost of each condition by age and gender for California.

Cost estimates from the CDC Cost Calculator include all additional or attributable medical expenditures for the entire state population (all payers and the uninsured) and include estimates of absenteeism. The estimates were derived from the 2004-2008 Medical Expenditure Panel Survey (MEPS) Consolidated Data Files,[6] a nationally representative survey of the civilian noninstitutionalized population that provides data on annual medical expenditures, sources of payment, insurance coverage, and days missed from work due to illness or injury for each participant. Diseases were defined using *ICD-9* (*International Classification of Diseases, Ninth Revision*) codes based on self-reported diseases that were transcribed by professional coders and reported in the MEPS Medical Conditions files for years 2004-2008 (see Table 1). The combined 5-year MEPS sample included 153 012 persons of all ages living in the United States. All expenditure data were inflated to 2010 dollars using the gross domestic product general price index.

To account for multiple chronic conditions and avoid double-counting (ie, overlap of disease costs) of the associated medical costs, the CDC Cost Calculator uses

TABLE 1 ● **Comparison of Rates of Chronic Diseases Reported for California by the CDC Cost Calculator and Data Sources Used in the Current Study**

	Age Range, y	CDC Cost Calculator		Prevalence Rates Used in This Study	
		Code[a]	Rate for California	Measure	Rate for California
Arthritis	0-17	Not available	Not available	Not available	Not available
	18 and older	*ICD-9*: 274, 354, 390, 391, 443, 446, 710-716, 719-721, 725-729	13.5%	Ever diagnosed with arthritis, gout, lupus, or fibromyalgia (*Ask*CHIS[b])	19.4%
Asthma	0-17	Not available	Not available	Ever diagnosed with asthma (*Ask*CHIS[b])	15.4%
	18 and older	CC: 128 *ICD-9*: 493	4.6%	Ever diagnosed with asthma (*Ask*CHIS[b])	13.8%
Cancer	0-17	Not available	Not available	SEER Stat and 2009 and 2010 SEER[c]	0.1%
	18 and older	CC: 11-43, 45	3.8%	SEER Stat and 2009 and 2010 SEER	4.4%
Cardiovascular disease	0-17	Not available	Not available	Not available	Not available
CHF	18 and older	*ICD-9*: 428	0.4%	Ever told have heart failure/CHF (*Ask*CHIS[b])	1.10%
CHD	18 and older	*ICD-9*: 410-414	3.1%	Ever diagnosed with heart disease (*Ask*CHIS[b])	6.2%
Hypertension	18 and older	*ICD-9*: 401-405	14.4%	Ever diagnosed with high blood pressure (*Ask*CHIS[b])	26.9%
Stroke	18 and older	*ICD-9*: 430-434, 436-438	1.1%	Ever had a stroke (*Ask*CHIS[b])	2.2%
Other heart diseases	18 and older	*ICD-9*: 390-392, 393-398, 415-416, 420-427, 429	1.9%	Not available	Not available
Depression	0-17	Not available	Not available	Likely has had frequent mental distress during past month (*Ask*CHIS[b])	9.8%
	18 and older	*ICD-9*: 296, 311	5.9%	Saw health professional for emotional/mental and/or alcohol-drug issues in past year (*Ask*CHIS[b])	12.3%
Diabetes	0-17	Not available	Not available	Diabetes prevalence (ADA[d])	0.3%
	18 and older	*ICD-9*: 250	6.1%	Ever diagnosed with diabetes (*Ask*CHIS[b])	8.2%

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]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.[5]
[b]From California Health Interview Survey.[6]
[c]From Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database.[9]
[d]From American Diabetes Association.[10]

estimates from a 2-stage statistical analysis that generates estimates of cost of multiple conditions. The resulting estimates of the costs of arthritis, asthma, cancer, CHF, CHD, stroke, other heart diseases, and depression are thus independent of the other conditions, although the cost estimates for hypertension and diabetes do include the costs of complications such as CHD, CHF, and stroke. The costs of hypertension and diabetes are therefore not mutually exclusive of the costs of other reported diseases. We report the estimated cost of CHF, CHD, stroke, and hypertension separately but report only the combined cost of CVD that includes these 4 conditions (we do not estimate costs for other heart diseases).

Adjustment of cost of chronic conditions by county

The CDC Cost Calculator provides estimates of the average attributable cost for each chronic condition at the state level by age strata and gender. To account for differences between counties in the cost per case due to variations in the price of health care services across the state, prices were adjusted using the Geographic Adjustment Factor reported by the Institute

of Medicine and based on the Centers for Medicare & Medicaid Studies Medicare geographic practice cost index for California.[7] The Geographic Adjustment Factor takes account of geographic differences due to 3 factors: cost of physician services, practice expenses due to location (eg, rent and cost of operating a facility), and geographic differences in malpractice or professional indemnity. The Geographic Adjustment Factor, which divides California into 9 distinct regions for which geographic practice cost indexes are calculated, was applied to the cost estimate for each condition, age, and gender for each region of California. The cost adjusters, ranging from 1.0323 to 1.1817, were applied to the cost estimates from the CDC Cost Calculator.

Prevalence rates for California

Estimates of the prevalence of the 6 chronic conditions of interest for California were derived from a variety of data sources, including *Ask*CHIS online query system for the California Health Interview Survey[8] and SEER (Surveillance Epidemiology and End Results)-Medicare data.[9] The rates summarized in Table 1 were derived from 3 sources: *Ask*CHIS,[8] SEER-Medicare data,[9] and the American Diabetes Association.[10] The number of cases was derived by multiplying the prevalence rates by the population per county as obtained from the 2010 Census.[11]

State-level prevalence rates for (*a*) arthritis, (*b*) asthma, (*c*) CVD, and (*d*) diabetes were obtained from the 2011 to 2012 California Health Interview Survey (CHIS). The CHIS is a representative population-based, random-dial, health survey of noninstitutionalized individuals in California[12] that is used to estimate prevalence rates for various health conditions at the state level and for large- and medium-sized counties at the county level (smaller counties are grouped together).[13] State-, regional-, and county-level estimation of various diseases and health-related behaviors surveyed in the CHIS can be obtained from the online Web tool *Ask*CHIS.[14] Because the 2011-2012 CHIS sample size was too small to obtain county-level prevalence rates for each age strata by race/ethnicity and gender, the analysis was conducted with state-level prevalence rates (rather than county-level rates).

Because the CHIS does not ask children and teens certain health questions, the prevalence for arthritis, CVDs, and diabetes for individuals aged 0 to 17 years was not available from the *Ask*CHIS query system. We obtained diabetes prevalence rates for individuals younger than 20 years from the American Diabetes Association *2011 National Diabetes Fact Sheet*.[10] We could not obtain prevalence rates for arthritis or CVD for children or teens, so we set the prevalence at zero in our estimations.

Cancer prevalence for each age strata by race/ethnicity and gender was calculated for each of the 58 California counties using the program SEER Stat and 2009 and 2010 SEER (written communication, January 31, 2014).[9] The county-level prevalence rates were estimated for the following strata to match the age groups used by SEER: 0-19, 20-44, 45-64, 65-79, and 80 years or older. Because of small sample sizes, no estimates were available for small counties or small demographic subgroups within counties. Small counties were therefore combined and average rates applied to each small county.

Population estimates

Population per county was calculated from the *2010 Census Summary File 1*, *Table PCT12*, provided by the California State Data Center.[11] This Table PCt12 presents the population of California and each Californian county race, gender, age, and Hispanic ethnicity. We used this table to calculate the population for each of the age, gender, and race/ethnicity condition for each of the 58 counties in California.

Compiling the cost estimates

The estimated cost of each chronic condition in each county of California was derived by multiplying:

- Estimate of the attributable cost for the age and gender for each condition (Table 2) adjusted for prices in the county;
- Prevalence of the condition by age group and gender for each county; and
- The number of people in each county by age, gender, and ethnicity.

This procedure resulted in estimates of each of the 6 conditions for each of the 58 counties by age, gender, and ethnicity. These estimates were then combined to calculate a total attributable cost per county. To provide counties with information on the relative importance of chronic diseases to their county, the results also report the percentage of their total health care expenditure that is due to chronic diseases. The total health care expenditure for each county was calculated by multiplying the population in the county by the average estimated health care expenditures for each person in California in 2010: $6238.[15]

● Results

Table 3 summarizes the results for California. Overall, there are more than 28 million cases of chronic conditions in California, with the most common being CVDs (36.4%), followed by arthritis (19.4%), asthma (14.2%), and depression (11.7%). Cancer is the least common

TABLE 2 ● Cost of Chronic Conditions in California by age, Gender, and Condition: From the CDC Cost Calculator Version 2[a]

	Male					Female				
	Age 0-17 y	Age 18-44 y	Age 45-64 y	Age 65-79 y	Age 80+ y	Age 0-17 y	Age 18-44 y	Age 45-64 y	Age 65-79 y	Age 80+ y
Arthritis	$840	$1 187	$1 830	$3 283	$3 632	$819	$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
Cardiovascular disease										
Hypertension	$0	$905	$1 233	$2 128	$3 176	$611	$974	$1 300	$2 200	$4 595
CHD	$1 250	$3 291	$4 428	$6 977	$7 251	$1 079	$3 502	$5 794	$8 894	$9 211
Stroke	$1 683	$4 272	$8 850	$12 694	$15 859	$2 369	$4 676	$8 929	$14 925	$25 351
CHF	$933	$2 611	$4 216	$7 306	$7 530	$885	$2 160	$5 322	$10 824	$12 033
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

Abbreviations: CDC, Centers for Disease Control and Prevention; CHD, coronary heart disease; CHF, congestive heart failure.
[a]Tables provided directly by the CDC for use in this study.

TABLE 3 ● Summary of the Number of Cases and Costs of Chronic Conditions in California in 2010

	No. Cases[a]	% Total Population[b]	Costs[c]	% Total Health Care Costs[d]
Arthritis	5 412 484	19.36[e]	$14 322 649 191	6.16
Asthma	5 292 537	14.21	$9 442 166 010	4.06
Cardiovascular disease	10 164 873	36.36[e]	$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
Cases of chronic conditions in California	28 757 130		$98 443 138 663	42.36

[a]Estimated total number of people with this condition in California.
[b]Estimated total number of cases divided by the total population of California (37 318 418).
[c]Estimated cost for each chronic condition in California.
[d]Estimated total cost of each chronic condition divided by the reported health care expenditure in California ($232 792 684 478).
[e]Estimated total number of cases divided by the adult total population of California.

condition (3.3%), with diabetes also being relatively infrequent. These 28 million cases do not suggest that 28 million people have a chronic condition, since people can have more than 1 chronic condition. On the basis of previous studies suggesting that 14 million (39% of the population) Californians have at least one chronic condition,[16] the estimates reported here suggest that these 14 million people have an average of nearly 2 chronic conditions (28 million conditions divided by 14 million people with a chronic condition).

The total cost for each condition and the percentage of the cost to overall health care expenditures in California are also shown in Table 3. Befitting its prevalence in the state, CVD is associated with the greatest expense, with more than $37 billion spent annually, or 16% of all health care costs in California. Despite its prevalence (14.2%), asthma has the lowest overall cost, contributing approximately 4% to the total health care expenditure. And cancer, despite its relatively low prevalence, is similar to the total health care expen-

ditures of other conditions ($13 billion, or 6% of total costs). Overall, the additional cost of treating chronic conditions is $98 million or approximately 42% of all health care expenditures in California.

The cost differences between counties (Table 4) reflect their relative populations, ethnicities, price adjustments, and rates of chronic conditions, with total costs varying from a high of $23 billion for Los Angeles County, $8 billion for Orange and San Diego counties, and $5 billion for Riverside County to $3.5 million for Alpine County and $12 million for Sierra County. Relative to the estimated total cost of health care in the county ($6238 per person in 2010),[11] counties with the estimated lowest spending on chronic conditions tend to be those with the youngest populations, including Kings and Kern counties (32% and 34% of total, respectively) whereas the counties with the highest spending have an older age distribution, including Amador (62%), Marin (61%, and Tuolumne (63%) counties.

TABLE 4 ● Cost of Chronic Conditions—By County in 2010

County	Population	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression	Total
Alameda	1 513 493	$603 200 845	$416 651 921	$1 583 810 838	$559 846 687	$598 655 472	$425 155 263	$4 187 321 026
Alpine	1 147	$596 944	$366 967	$1 436 076	$403 210	$283 476	$421 641	$3 508 314
Amador	37 907	$23 335 555	$11 831 389	$60 004 057	$15 747 627	$22 678 304	$13 569 954	$147 166 887
Butte	220 024	$106 795 972	$62 434 861	$274 329 859	$72 334 458	$109 150 629	$72 129 961	$697 175 740
Calaveras	45 258	$28 087 993	$14 361 058	$70 558 179	$18 870 355	$23 974 424	$16 642 233	$172 494 242
Colusa	21 452	$7 990 069	$5 001 373	$21 050 853	$7 116 832	$5 922 104	$5 640 151	$52 721 383
Contra Costa	1 052 192	$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	28 577	$12 930 224	$8 027 006	$32 548 308	$8 927 040	$11 286 741	$9 095 277	$82 814 598
El dorado	181 183	$89 215 578	$51 716 197	$217 569 923	$60 166 936	$82 370 516	$61 242 662	$562 281 813
Fresno	933 075	$305 789 841	$211 250 531	$808 862 366	$294 463 208	$268 349 029	$230 577 738	$2 119 292 713
Glenn	28 188	$11 739 159	$7 110 624	$30 311 474	$9 121 236	$11 635 207	$8 111 948	$78 029 648
Humboldt	134 575	$61 519 901	$38 722 535	$151 899 598	$40 220 171	$58 774 894	$45 404 362	$396 541 461
Imperial	175 594	$55 949 074	$36 324 821	$154 588 774	$72 238 607	$40 430 695	$39 783 079	$399 315 050
Inyo	18 627	$10 720 589	$5 722 643	$28 239 007	$7 470 878	$9 759 065	$6 347 939	$68 260 121
Kern	841 744	$262 830 425	$190 132 965	$671 492 969	$238 920 895	$203 208 952	$213 760 975	$1 780 347 182
Kings	153 020	$43 845 793	$33 480 435	$112 838 577	$42 915 901	$30 100 669	$37 466 087	$300 647 462
Lake County	64 466	$35 413 535	$19 276 408	$89 479 100	$24 493 644	$31 236 210	$22 258 692	$222 157 588
Lassen	34 730	$13 148 960	$9 079 780	$32 448 597	$9 270 638	$8 415 193	$10 538 984	$82 902 152
Los Angeles	9 827 070	$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	151 160	$55 411 350	$36 081 461	$143 725 796	$49 446 160	$47 496 470	$40 504 021	$372 665 259
Marin	252 767	$145 286 826	$79 518 138	$367 294 263	$99 991 067	$182 558 622	$91 425 607	$966 074 523
Mariposa	18 119	$11 341 304	$5 832 104	$28 610 493	$7 544 800	$9 191 028	$6 734 940	$69 254 670
Mendocino	87 939	$43 869 916	$25 129 989	$110 852 435	$30 354 312	$41 949 416	$28 996 964	$281 153 032
Merced	256 386	$79 206 945	$56 404 903	$207 733 416	$77 289 002	$64 699 197	$62 010 549	$547 344 013
Modoc	9 676	$5 593 338	$2 954 470	$14 251 471	$3 725 272	$4 083 251	$3 391 060	$33 998 861
Mono	14 114	$5 333 561	$3 675 870	$12 435 183	$3 735 059	$3 092 737	$4 449 052	$32 721 462
Monterey	415 825	$145 238 687	$95 254 830	$384 687 421	$136 234 787	$142 621 186	$105 055 375	$1 009 092 286
Napa	136 681	$69 192 770	$39 353 263	$181 348 727	$52 852 239	$72 976 675	$44 266 337	$459 990 010
Nevada	98 484	$59 046 177	$30 580 542	$149 443 796	$38 150 475	$59 456 213	$35 784 249	$372 461 452
Orange	3 017 089	$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

(Continues)

TABLE 4 ● **Cost of Chronic Conditions—By County in 2010 (*Continues*)**

County	Population	Arthritis	Asthma	Cardiovascular Disease	Diabetes	Cancer	Depression	Total
Placer	350 609	$167 254 158	$97 546 613	$421 563 734	$115 650 919	$146 754 175	$112 566 473	$1 061 336 072
Plumas	19 993	$12 448 898	$6 394 841	$31 150 935	$8 108 658	$11 258 000	$7 465 113	$76 826 445
Riverside	2 191 800	$813 709 135	$526 735 895	$2 137 580 822	$717 813 688	$648 222 639	$581 161 863	$5 425 224 042
Sacramento	1 420 447	$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	55 350	$18 859 647	$12 514 724	$48 363 545	$18 469 274	$16 584 444	$14 427 243	$129 218 877
San Bernardino	2 038 771	$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	3 104 581	$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	807 177	$364 916 603	$238 823 878	$984 296 489	$356 839 887	$406 510 177	$240 580 980	$2 591 968 013
San Joaquin	686 761	$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	269 753	$131 085 983	$75 571 203	$335 181 404	$92 499 798	$122 248 021	$87 680 987	$844 267 395
San Mateo	719 582	$338 300 223	$208 486 911	$901 149 172	$298 671 887	$406 413 572	$217 496 627	$2 370 518 391
Santa Barbara	424 291	$171 891 380	$105 352 991	$454 608 419	$143 411 773	$183 508 207	$118 876 484	$1 177 649 254
Santa Clara	1 787 553	$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	263 174	$105 753 024	$67 563 132	$262 565 319	$81 591 198	$108 375 540	$79 423 363	$705 271 576
Shasta County	177 480	$93 160 668	$52 510 610	$234 525 831	$60 766 241	$94 309 971	$60 979 408	$596 252 729
Sierra County	3 231	$2 048 997	$1 036 900	$5 055 401	$1 355 235	$1 645 669	$1 231 504	$12 373 706
Siskiyou	44 951	$26 532 352	$13 984 048	$67 887 328	$17 712 645	$23 262 973	$16 019 877	$165 399 224
Solano	413 220	$173 424 811	$117 208 931	$443 310 016	$150 875 202	$162 910 920	$124 579 029	$1 172 308 909
Sonoma	484 258	$225 640 815	$132 665 200	$569 745 118	$160 728 489	$226 359 415	$153 888 216	$1 469 027 254
Stanislaus	515 311	$184 921 719	$123 823 604	$474 089 392	$156 523 758	$154 312 254	$139 993 774	$1 233 664 501
Sutter	94 800	$36 864 012	$23 698 936	$95 548 634	$30 317 698	$31 782 892	$25 850 874	$244 063 046
Tehama	63 635	$30 829 593	$17 724 199	$77 834 396	$21 421 109	$29 134 259	$20 472 921	$197 416 478
Trinity	13 883	$8 418 767	$4 434 550	$21 100 931	$5 519 846	$7 426 006	$5 131 822	$52 031 923
Tulare	443 638	$137 552 295	$96 214 045	$361 160 115	$133 570 747	$115 831 945	$107 502 680	$951 831 827
Tuolumne	54 961	$33 398 552	$17 170 796	$85 752 176	$22 254 505	$38 074 375	$19 738 129	$216 388 532
Ventura	825 378	$338 130 092	$213 394 737	$868 583 588	$288 950 045	$337 506 353	$242 098 847	$2 288 663 662
Yolo	200 995	$68 736 320	$48 741 387	$174 477 936	$56 837 625	$62 968 498	$55 085 366	$466 847 131
Yuba	72 336	$25 367 216	$18 013 850	$62 338 978	$19 255 146	$21 163 615	$20 651 712	$166 790 518
Total for California	37 318 481	$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

● Conclusions

Summary

The purpose of this report was to estimate the cost of chronic conditions for each county in California. We combined estimates from the CDC Cost Calculator of the cost per person for each of 6 chronic conditions—arthritis, asthma, cancer, CVD, diabetes, and depression—with prevalence rates and census data from counties in California to develop estimates of the number of cases in each county and the cost associated with these conditions. The results suggest that approximately $98 billion is currently spent on treating chronic conditions in California. This represents approximately 42% of all health care expenditure in the state.

Previous studies have estimated the cost of chronic conditions at the national level,[17-20] with some estimates also available for individual states. However, while individual counties have attempted to estimate the cost of chronic conditions in their region (eg, San Diego County[21]), this is the first attempt to estimate the cost of chronic conditions for multiple counties in a state. Because the CDC Cost Calculator provides estimates of the attributable or additional cost of the chronic conditions, the estimates represent the amount that could be saved if chronic diseases were eliminated or reduced.

Understanding the savings that could be made through enhanced prevention activities is important for LHD planning. Under the Affordable Care Act, many previously uninsured people now have access to affordable prevention services. This provides a unique opportunity for LHDs to reduce the future burden of chronic conditions by investing in or helping people gain access to effective prevention activities. But because budgets are likely to remain limited, LHDs must identify prevention activities that are "worth the money," meaning that they need to identify whether the health outcomes from a prevention activity justify the investment they will have to make. For instance, since 2007, the CDC has made a program called PRISM (Prevention Impacts Simulation Model) available to help local health officials understand the health and cost outcomes from a number of interventions, including medical care (14 separate interventions), smoking (n = 5), nutrition and weight loss (n = 8), physical activity (n = 4), emotional distress (n = 2), and particulate air pollution (n = 1).[22] The diseases and conditions modeled in detail include heart disease, stroke, diabetes, hypertension, high cholesterol level, and obesity, and the model also accounts for cancers and respiratory diseases related to smoking, obesity, poor nutrition, and physical inactivity. Combining this type of information with the cost of the condi-

tion can provide LHDs with an understanding of their return on investment from possible prevention activities.

The estimates derived in this study differ somewhat from the estimates from the CDC regarding the cost of chronic conditions. As summarized in Table 5, the overall cost estimate of $98 billion is approximately 14% higher than the CDC's estimate of $87 billion for California. While the estimated cost of each chronic condition was the same (Table 2), the prices were adjusted to account for differences between counties (Table 4). Most significantly, the prevalence rates used in the current study differed significantly: the CDC estimates relying on prevalence rates from the MEPS compared with the use of *Ask*CHIS in this study. The California-specific *Ask*CHIS rates were determined by an advisory group of regional experts as being more accurate than the MEPS rates. However, because the CHIS relied on self-reports of chronic conditions whereas the MEPS used *ICD-9* codes from clinical diagnosis, the rates do differ, sometimes significantly (Table 1). The difference in prevalence rates translates into differences in costs, with the largest difference being the estimated cost associated with asthma ($6 billion higher than the CDC estimate). Neither approach is without its limitations (the MEPS having a relatively small California sample size, the CHIS relying on self-reports) and thus the results might best be viewed as providing a different perspective on the costs of chronic conditions in California. Finally, the calculation of the percentage of cost attributable to chronic conditions (Table 3) should be interpreted with caution since the total cost was derived from a different estimate (Centers for Medicare & Medicaid Studies National Health Expenditure Accounts) than the cost estimates (derived from the MEPS).

Limitations

As this was the first attempt to adapt the CDC Cost Calculator to estimate costs at the county level, the study encountered a number of methodological issues. These include the following:

Accuracy of county prevalence rates: The majority of prevalence rates were obtained from the CHIS. While the CHIS is widely respected and commonly used, the sample size for 1 year is not large enough to produce reliable estimates for some groups (especially in some underserved regions) and reliance on self-reported diagnoses (as opposed to medical records as does the MEPS) raise questions about the accuracy of the estimates. Additional study is needed to develop adjusters for county-level rates. In addition, because the CHIS does not include

TABLE 5 ● Comparing Estimates From the Current Study With CDC Estimates for California

	Estimates From This Study, A	Estimates From CDC Cost Calculator,[a] B	Difference (A − B), C	Percentage (C/B)
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	$39 570 000 000	-$2 080 573 172	− 5%
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	$86 679 000 000	$11 764 138 663	14%

Abbreviation: CDC, Centers for Disease Control and Prevention.
[a]Sum of reported estimates for California of the conditions listed.[4]

people in institutional care, the costs reported are underestimates of the total cost. Finally, while it was not possible to develop standard deviations or confidence intervals given the components of these estimates (eg, CDC cost estimates and census data), additional analysis might explore using probabilistic sensitivity analysis to explore the robustness of the results to changes in key parameters.

Accuracy of estimates for small counties/younger ages: The cost calculations likely underestimate the cost of chronic disease for individuals aged 0 to 17 years and for small counties or small demographic subgroups. Because the CHIS does not ask children and teens certain health questions, it was not possible to determine the prevalence for arthritis and CVDs, as well as for diabetes for individuals aged 0 to 17. As cancer prevalence rates were obtained by strata, race/ethnicity, and gender for each of the 58 California counties using SEER data, small populations in some counties or demographic subgroups within counties made it necessary to pool the small counties when determining cancer rates.

Adjusting for differences in health services usage between counties: The estimates shown earlier account for differences in the cost to counties based on age, gender, prices in the region, population in the region, and (to some degree) rates of chronic conditions per county. Left unaccounted for are differences in the intensity of health care usage for a given condition. This can arise because of differences in the availability of medical facilities, differences in practice between regions, and differences in ability to pay.

A reliable source of data on health services usage in California is the state hospital (OSHPD) data. This data set contains all hospitalizations for the state in a given year. Estimating differences in rates of hospitalizations will give an indication of the differences in hospital use between counties. A thorough estimation of the differences between counties in health services usage was not feasible for this study, thus suggesting that differences between counties may be understated, with counties with relatively few health services (ie, medically underserved regions) likely to exhibit lower overall costs of care whereas those in more affluent areas likely to exhibit higher overall costs.

Implications

This study represents an initial attempt to estimate the cost of chronic conditions in counties in California. Additional information is needed to help counties identify the return on investment from prevention activities, including the health gains that would result, the parties that would incur additional costs and those who would financially benefit, and the health care providers and other organizations that would need to be involved to make the prevention activities successful. Having accurate estimates of the cost of chronic diseases provides LHDs with an understanding of the challenges facing the people in their region. Information on the burden chronic conditions place on each provider (eg, private insurers, Medicare, and Medicaid) will provide more accurate estimates of the amount of expenditure that each funder could avoid by engaging in prevention activities. As more people are covered by some form of health insurance in California, there is an opportunity to expand prevention services, especially to vulnerable and at-risk populations. This expansion will require increased planning and organization, particularly from local public health departments, as reducing the number of individuals with chronic disease will take not only individual-level prevention services but also institutional- and population-level interventions. Information on the economic cost of chronic conditions is important for planning prevention and control efforts, as it provides decision makers with an estimate of the amount that could be saved if chronic conditions were prevented or controlled.

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