Potentially Preventable Deaths Among the Five Leading Causes of Death — United States, 2010 and 2014

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Death rates by specific causes vary across the 50 states and the District of Columbia.* Information on differences in rates for the leading causes of death among states might help state health officials determine prevention goals, priorities, and strategies. CDC analyzed National Vital Statistics System data to provide national and state-specific estimates of potentially preventable deaths among the five leading causes of death in 2014 and compared these estimates with estimates previously published for 2010. Compared with 2010, the estimated number of potentially preventable deaths changed (supplemental material at https://stacks.cdc.gov/view/cdc/42472); cancer deaths decreased 25% (from 84,443 to 63,209), stroke deaths decreased 11% (from 16,973 to 15,175), heart disease deaths decreased 4% (from 91,757 to 87,950), chronic lower respiratory disease (CLRD) (e.g., asthma, bronchitis, and emphysema) deaths increased 1% (from 28,831 to 29,232), and deaths from unintentional injuries increased 23% (from 36,836 to 45,331). A better understanding of progress made in reducing potentially preventable deaths in the United States might inform state and regional efforts targeting the prevention of premature deaths from the five leading causes in the United States.

To determine significant changes in the number of potentially preventable deaths for the five leading causes of death in the United States, CDC analyzed National Vital Statistics System mortality data from 2014 (*1*) using the same analytic model presented in the original report that used 2010 data as benchmarks (*2*). The number of potentially preventable deaths per year per state in persons aged <80 years was determined by comparing the number of expected deaths (based on the cause-specific average death rate of the three states with the lowest 2008–2010

average rate by age groups) with the number of observed deaths in 2010 and 2014. Further detail on age-adjusted rates by state and cause can be found in yearly publications on final death data (*1*).

Population estimates for 2010 and 2014 were produced by the U.S. Census Bureau. The calculations of potentially preventable deaths were restricted to U.S. residents and deaths in persons aged <80 years. Premature death was defined as a death that occurred in a person aged <80 years, based on the average life expectancy for the total U.S. population, which was nearly

Continuing Education examination available at http://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

* http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf.

79 years in 2010 (*2*). Analysis was restricted to deaths with an underlying cause of death among the five leading causes, based on *International Classification of Diseases, 10th Revision* (ICD-10) codes.[†] The five leading causes of death represented 63% of all deaths in 2014, a decrease of 2.3% compared with 2010. In 2014 the next five most frequent causes accounted for approximately 12% of deaths (*3*).

The number of potentially preventable deaths for each of the five leading causes of death by state in 2014 was calculated in four steps. The first step was to calculate and rank state disease-specific death rates by age group. Using 2008–2010 data, the three states with the lowest observed death rates for each age group and specific cause of death category were selected and their death rates averaged across the three states to calculate a lowest average age-specific death rate for each cause of death. For example, during 2008–10, among persons aged 40–49 years, the three states with the lowest rate of death from unintentional injuries were Maryland, New Jersey, and New York, and the benchmark average was 25.2 (supplemental material at https://stacks. cdc.gov/view/cdc/42342).

The average of the lowest three states was chosen to minimize the effect of any extreme outlier and to represent the low end of the distribution of death rates among the states. The second step was to calculate expected deaths for each age group and state by multiplying the age-specific state populations for 2010 by the 2010 benchmark death rates (i.e., the lowest three-state average age-specific death rates for each cause). Total expected deaths for each cause and state were calculated by summing expected deaths over all age groups aged <80 years, effectively taking into account differences in mortality across age groups. These state-specific and cause-specific expected death counts represent the number of deaths expected if all states were to achieve the 2010 death rate benchmarks (*2*). Third, the 2010 potentially preventable deaths were calculated by subtracting expected deaths from 2010 observed deaths. Finally, the same 2010 benchmark death rates for each cause were used to calculate 2014 potentially preventable deaths by repeating the third and fourth steps with 2014 population and mortality data. Specifically, the number of expected deaths in 2014 was calculated by multiplying the 2010 benchmark death rates by the 2014 age-specific populations; these expected counts were then subtracted from 2014 observed deaths. The numbers of potentially preventable deaths for each cause were assumed to follow a Poisson distribution, and standard errors were calculated, taking into account stochastic variation, consistent with methods described previously (*2*), in both the expected and observed number of deaths[§] for each cause and year. Statistically significant changes from 2010–2014 were

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[†] Diseases of the heart codes I00-I09, I11, I13, I20-I51; cancer C00-C97; CLRD J40-J47; cerebrovascular diseases (stroke) I60-I69; and unintentional injuries V01-X59, Y85-Y86.

[§] Standard error = the square root of [expected number + observed number of deaths].

assessed using a two-sided z-test (p<0.01). Results are presented for the United States as a whole, by state, and by the 10 U.S. Department of Health and Human Services regions.¶

The five leading causes of death for persons aged <80 years in 2014 (diseases of the heart, malignancies [cancer], cerebrovascular diseases [stroke], chronic lower respiratory diseases [CLRD], and unintentional injuries [accidents]) represent 63% of deaths from all causes. The estimated number of potentially preventable deaths and the proportion preventable among the five leading causes of death in persons aged <80 years were 87,950 for diseases of the heart (30% preventable); 63,209 for cancer (15% preventable); 45,331 for unintentional injuries

(43% preventable); 29,232 for CLRD (36% preventable); and 15,175 for stroke (28% preventable) (Figure).

Potentially preventable deaths from cancer declined 25% from 2010 to 2014 (the increase in the expected number of deaths was greater than the increase in the observed number). This decline appears to be driven by a 12% decrease in the age-adjusted death rate from lung cancer from 2010 and 2014. Decreases in age-adjusted death rates from cancer were observed across all U.S. states, except the District of Columbia (supplemental material at https://stacks.cdc.gov/view/cdc/42343). The expected number of deaths was based on benchmark death rates from 2010; however, cancer-related death rates declined during 2010–2014. In both 2010 and 2014 the Southeast (Region 4) had the highest number of potentially preventable deaths for each of the five leading causes of death (Table 1). In 2014, the Northwest (Region 10) had the lowest number of potentially preventable deaths for each of the five leading causes of death except deaths from CLRD and unintentional injuries, where the lowest number occurred in New York and New Jersey (Region 2) (Table 2).

Consistent with increases in population since 2010, particularly among older age groups, the number of observed deaths

¶ *Region 1:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. *Region 2:* New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands. *Region 3:* Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. *Region 4:* Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. *Region 5:* Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. *Region 6:* Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. *Region 7:* Iowa, Kansas, Missouri, and Nebraska. *Region 8:* Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. *Region 9:* Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau. *Region 10:* Alaska, Idaho, Oregon, and Washington.

FIGURE. Number of potentially preventable deaths among the five leading causes of death, for persons aged <80 years — United States, 2010 and 2014

TABLE 1. Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by U.S. Department of Health and Human Services (HHS) region — United States, 2010 and 2014

HHS region	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable	Expected	Observed	Potentially preventable	
Diseases of the heart							
1	8,904	10,286	1,382	9,798	10,468	670	*
2	16,765	24,477	7,712	18,170	24,272	6,102	*
3	18,327	28,563	10,236	20,099	29,185	9,086	*
4	38,367	65,198	26,831	43,235	69,897	26,662	
5	30,726	47,280	16,554	33,618	50,437	16,819	
6	20,656	35,898	15,242	23,245	39,907	16,662	*
7	8,281	12,769	4,488	8,958	13,425	4,467	
8	5,782	6,464	682	6,616	7,325	709	
9	26,030	33,352	7,322	29,622	35,133	5,511	*
10	7,422	8,401	979	8,539	9,216	677	
Malignant neoplasms (cancers)							
1	15,587	19,061	3,474	17,216	18,995	1,779	*
2	29,259	34,735	5,476	31,827	34,826	2,999	*
3	32,039	42,003	9,964	35,241	43,236	7,995	*
4	66,962	90,439	23,477	75,522	95,461	19,939	*
5	53,686	71,553	17,867	58,975	73,529	14,554	*
6	36,074	46,950	10,876	40,693	49,216	8,523	*
7	14,443	19,028	4,585	15,692	19,653	3,961	
8	10,123	10,708	585	11,625	11,387	-238[†]	*
9	45,439	50,611	5,172	51,835	53,179	1,344	*
10	13,041	15,861	2,820	15,018	16,700	1,682	*
Cerebrovascular diseases (stroke)							
1	1,722	1,863	141	1,914	1,781	-133	*
2	3,261	3,742	481	3,556	3,716	160	*
3	3,568	5,239	1,671	3,947	5,511	1,564	
4	7,538	12,960	5,422	8,567	13,934	5,367	
5	5,988	8,832	2,844	6,603	9,143	2,540	
6	4,040	7,174	3,134	4,575	7,749	3,174	
7	1,628	2,405	777	1,773	2,490	717	
8	1,128	1,374	246	1,302	1,440	138	
9	5,078	6,904	1,826	5,822	6,952	1,130	*
10	1,439	1,867	428	1,679	1,991	312	
Chronic lower respiratory diseases (CLRD)							
1	2,234	2,774	540	2,505	3,068	563	
2	4,218	4,794	576	4,634	4,697	63	*
3	4,630	6,951	2,321	5,166	7,234	2,068	
4	9,820	18,612	8,792	11,254	21,025	9,771	*
5	7,740	13,494	5,754	8,623	14,669	6,046	
6	5,174	9,539	4,365	5,911	10,547	4,636	
7	2,111	4,318	2,207	2,317	4,644	2,327	
8	1,442	2,447	1,005	1,686	2,681	995	
9	6,514	8,447	1,933	7,550	8,977	1,427	*
10	1,857	3,082	1,225	2,195	3,357	1,162	
Unintentional injuries (accidents)							
1	2,771	3,703	932	2,866	4,817	1,951	*
2	5,357	5,692	335	5,531	6,824	1,293	*
3	5,703	8,769	3,066	5,916	10,261	4,345	*
4	11,650	23,804	12,154	12,338	24,789	12,451	
5	9,724	15,104	5,380	9,984	17,898	7,914	*
6	7,040	13,487	6,447	7,530	14,598	7,068	*
7	2,566	4,720	2,154	2,639	4,901	2,262	
8	1,985	3,479	1,494	2,136	4,046	1,910	*
9	8,845	12,264	3,419	9,420	13,768	4,348	*
10	2,414	3,840	1,426	2,569	4,358	1,789	*

* Significant change from 2010 to 2014, $p<0.01$.
[†] Negative potentially preventable deaths occurred when an HHS region included one or more of the states with the lowest three death rates (the lowest three death rates were averaged to create the benchmark death rates) for at least a few age groups. Negative potentially preventable deaths are preserved in this table to test changes from 2010 to 2014.
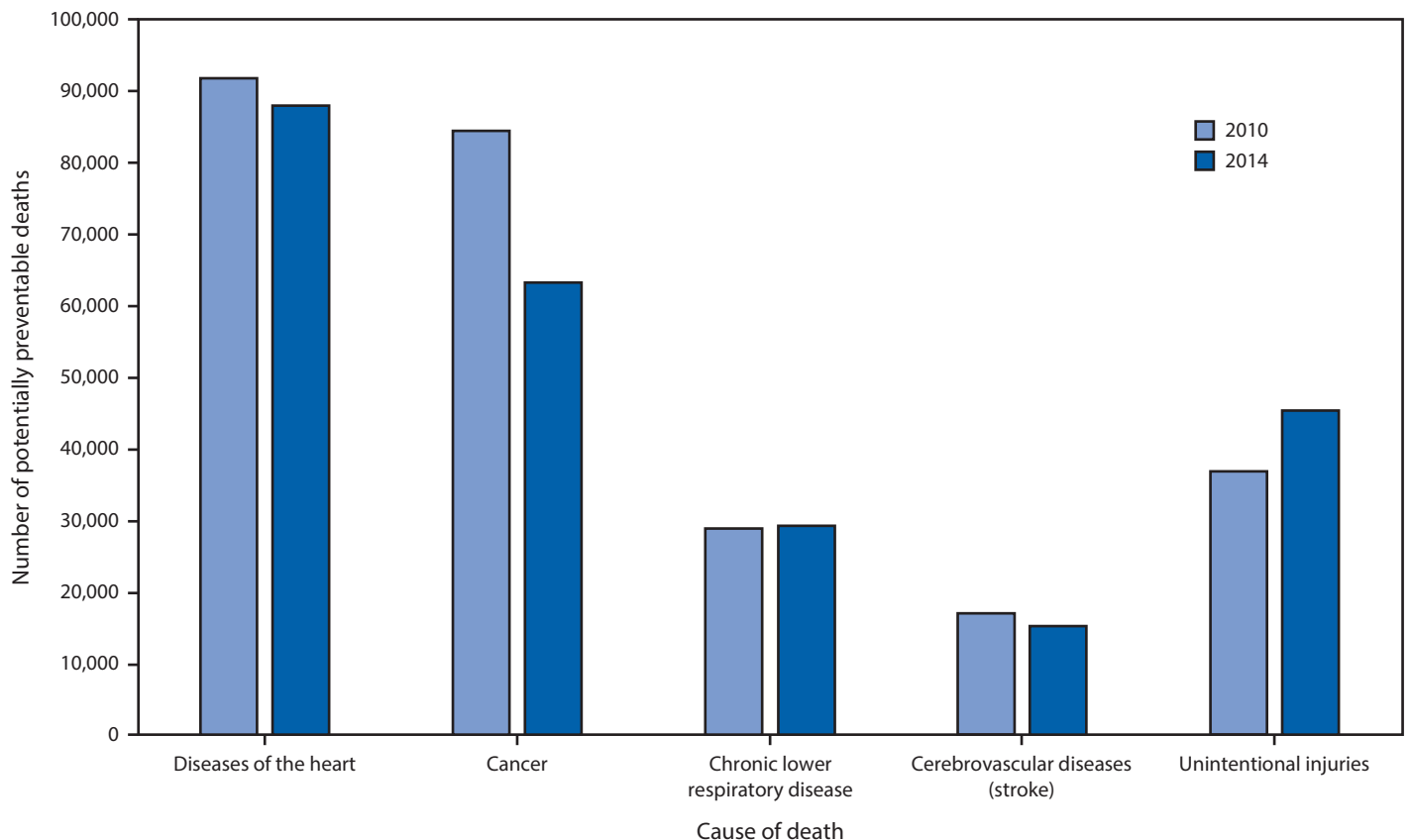
TABLE 2. Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by state — United States, 2010 and 2014

State	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable (95% CI)	Expected	Observed	Potentially preventable (95% CI)	
Diseases of the heart							
Alabama	2,993	6,604	3,611 (3,419–3,803)	3,266	6,933	3,667 (3,469–3,865)	
Alaska	331	463	132 (77–187)	377	497	120 (62–178)	
Arizona	3,885	4,735	850 (668–1,032)	4,512	5,061	549 (357–741)	
Arkansas	1,845	3,808	1,963 (1,816–2,110)	1,998	4,258	2,260 (2,105–2,415)	*
California	19,742	24,707	4,965 (4,552–5,378)	22,358	25,338	2,980 (2,552–3,408)	*
Colorado	2,707	2,815	108 (-38–254)	3,153	3,246	93 (-64–250)	
Connecticut	2,176	2,569	393 (258–528)	2,362	2,552	190 (53–327)	
Delaware	575	857	282 (208–356)	658	929	271 (193–349)	
District of Columbia	310	729	419 (356–482)	337	733	396 (332–460)	
Florida	13,352	17,586	4,234 (3,889–4,579)	15,121	19,121	4,000 (3,637–4,363)	
Georgia	5,120	9,103	3,983 (3,749–4,217)	5,890	9,911	4,021 (3,775–4,267)	
Hawaii	836	1,007	171 (87–255)	920	1,217	297 (206–388)	
Idaho	883	1,080	197 (110–284)	1,025	1,240	215 (122–308)	
Illinois	7,249	11,424	4,175 (3,907–4,443)	7,898	11,839	3,941 (3,666–4,216)	
Indiana	3,783	6,421	2,638 (2,440–2,836)	4,145	6,779	2,634 (2,429–2,839)	
Iowa	1,892	2,716	824 (691–957)	2,032	2,622	590 (456–724)	
Kansas	1,636	2,248	612 (490–734)	1,766	2,402	636 (509–763)	
Kentucky	2,662	5,332	2,670 (2,495–2,845)	2,912	5,798	2,886 (2,703–3,069)	
Louisiana	2,609	5,784	3,175 (2,995–3,355)	2,861	6,149	3,288 (3,102–3,474)	
Maine	928	1,083	155 (67–243)	1,026	1,167	141 (49–233)	
Maryland	3,303	5,321	2,018 (1,836–2,200)	3,701	5,476	1,775 (1,587–1,963)	
Massachusetts	3,926	4,416	490 (311–669)	4,333	4,382	49 (-134–232)	*
Michigan	6,056	10,327	4,271 (4,020–4,522)	6,646	11,461	4,815 (4,551–5,079)	*
Minnesota	3,050	2,720	-330[†] (-479 to -181)	3,414	2,951	-463 (-619 to -307)	
Mississippi	1,750	4,183	2,433 (2,282–2,584)	1,903	4,428	2,525 (2,369–2,681)	
Missouri	3,691	6,553	2,862 (2,664–3,060)	4,011	7,113	3,102 (2,895–3,309)	
Montana	650	826	176 (101–251)	733	910	177 (98–256)	
Nebraska	1,063	1,252	189 (95–283)	1,149	1,288	139 (42–236)	
Nevada	1,566	2,903	1,337 (1,206–1,468)	1,832	3,517	1,685 (1,542–1,828)	*
New Hampshire	828	916	88 (6–170)	931	976	45 (-41–131)	
New Jersey	5,243	7,106	1,863 (1,645–2,081)	5,703	7,145	1,442 (1,220–1,664)	*
New Mexico	1,253	1,510	257 (154–360)	1,382	1,642	260 (152–368)	
New York	11,522	17,371	5,849 (5,516–6,182)	12,467	17,127	4,660 (4,323–4,997)	*
North Carolina	5,679	9,021	3,342 (3,104–3,580)	6,456	9,223	2,767 (2,522–3,012)	*
North Dakota	406	512	106 (47–165)	437	542	105 (44–166)	
Ohio	7,164	11,875	4,711 (4,441–4,981)	7,736	12,697	4,961 (4,681–5,241)	
Oklahoma	2,267	4,857	2,590 (2,425–2,755)	2,456	5,300	2,844 (2,671–3,017)	
Oregon	2,364	2,421	58 (-79–193)	2,714	2,622	-92 (-235–51)	
Pennsylvania	8,221	12,668	4,447 (4,164–4,730)	8,824	12,689	3,865 (3,578–4,152)	*
Rhode Island	636	820	184 (109–259)	689	855	166 (89–243)	
South Carolina	2,896	5,413	2,517 (2,338–2,696)	3,335	5,742	2,407 (2,220–2,594)	
South Dakota	491	590	99 (35–163)	541	741	200 (130–270)	
Tennessee	3,916	7,956	4,040 (3,826–4,254)	4,353	8,741	4,388 (4,164–4,612)	
Texas	12,683	19,939	7,256 (6,902–7,610)	14,549	22,558	8,009 (7,631–8,387)	*
Utah	1,194	1,229	35 (-61–131)	1,383	1,349	-34 (-136–68)	
Vermont	411	482	71 (12–130)	457	536	79 (17–141)	
Virginia	4,609	6,588	1,979 (1,772–2,186)	5,185	6,978	1,793 (1,577–2,009)	
Washington	3,844	4,437	593 (415–771)	4,424	4,857	433 (244–622)	
West Virginia	1,308	2,400	1,092 (973–1,211)	1,395	2,380	985 (865–1,105)	
Wisconsin	3,424	4,513	1,089 (914–1,264)	3,779	4,710	931 (750–1,112)	
Wyoming	333	492	159 (103–215)	369	537	168 (109–227)	
United States	**181,261**	**272,688**	**91,757 (90,436–93,078)**	**201,902**	**289,265**	**87,950 (86,576–89,324)**	*
Malignant neoplasms (cancers)							
Alabama	5,227	7,595	2,368 (2,146–2,590)	5,714	7,796	2,082 (1,854–2,310)	
Alaska	588	703	115 (45–185)	670	782	112 (37–187)	
Arizona	6,775	7,460	685 (451–919)	7,857	8,085	228 (-19–475)	*
Arkansas	3,219	4,720	1,501 (1,326–1,676)	3,487	4,897	1,410 (1,231–1,589)	
California	34,454	38,226	3,772 (3,244–4,300)	39,157	39,678	521 (-29–1071)	*
Colorado	4,752	4,944	192 (-1–385)	5,553	5,188	-365 (-568 to -162)	*
Connecticut	3,805	4,367	562 (385–739)	4,144	4,219	75 (-104–254)	*
Delaware	1,006	1,352	346 (251–441)	1,151	1,426	275 (176–374)	

See table footnotes on page 1253.

TABLE 2. (*Continued*) Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by state — United States, 2010 and 2014

State	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable (95% CI)	Expected	Observed	Potentially preventable (95% CI)	
District of Columbia	543	742	199 (129–269)	592	837	245 (171–319)	
Florida	23,195	28,249	5,054 (4,609–5,499)	26,279	29,519	3,240 (2,777–3,703)	*
Georgia	8,967	11,820	2,853 (2,570–3,136)	10,323	12,738	2,415 (2,117–2,713)	
Hawaii	1,467	1,555	88 (-20–196)	1,616	1,693	77 (-36–190)	
Idaho	1,546	1,753	207 (94–320)	1,796	1,995	199 (78–320)	
Illinois	12,654	16,558	3,904 (3,569–4,239)	13,840	16,862	3,022 (2,679–3,365)	*
Indiana	6,612	9,385	2,773 (2,525–3,021)	7,268	9,821	2,553 (2,297–2,809)	
Iowa	3,295	4,127	832 (663–1,001)	3,559	4,258	699 (526–872)	
Kansas	2,854	3,624	770 (612–928)	3,098	3,758	660 (498–822)	
Kentucky	4,655	7,499	2,844 (2,628–3,060)	5,104	7,815	2,711 (2,488–2,934)	
Louisiana	4,562	6,909	2,347 (2,137–2,557)	5,021	7,137	2,116 (1,900–2,332)	
Maine	1,627	2,259	632 (510–754)	1,805	2,186	381 (257–505)	*
Maryland	5,788	7,218	1,430 (1,206–1,654)	6,499	7,616	1,117 (884–1,350)	
Massachusetts	6,865	8,319	1,454 (1,212–1,696)	7,609	8,341	732 (484–980)	*
Michigan	10,600	14,394	3,794 (3,484–4,104)	11,671	14,884	3,213 (2,894–3,532)	
Minnesota	5,328	6,273	945 (734–1,156)	5,992	6,267	275 (58–492)	*
Mississippi	3,055	4,731	1,676 (1,503–1,849)	3,330	5,019	1,689 (1,510–1,868)	
Missouri	6,442	9,023	2,581 (2,337–2,825)	7,020	9,345	2,325 (2,074–2,576)	
Montana	1,143	1,304	161 (64–258)	1,291	1,445	154 (51–257)	
Nebraska	1,852	2,254	402 (276–528)	2,014	2,292	278 (149–407)	
Nevada	2,743	3,370	627 (474–780)	3,205	3,723	518 (355–681)	
New Hampshire	1,455	1,772	317 (206–428)	1,642	1,846	204 (88–320)	
New Jersey	9,147	10,948	1,801 (1,523–2,079)	9,986	10,965	979 (695–1,263)	*
New Mexico	2,194	2,393	199 (66–332)	2,423	2,451	28 (-109–165)	
New York	20,112	23,787	3,675 (3,264–4,086)	21,842	23,861	2,019 (1,600–2,438)	*
North Carolina	9,931	13,297	3,366 (3,067–3,665)	11,304	14,393	3,089 (2,775–3,403)	
North Dakota	708	780	72 (-4–148)	767	852	85 (6–164)	
Ohio	12,514	17,413	4,899 (4,560–5,238)	13,570	18,043	4,473 (4,125–4,821)	
Oklahoma	3,957	5,787	1,830 (1,637–2,023)	4,293	5,896	1,603 (1,405–1,801)	
Oregon	4,153	5,212	1,059 (869–1,249)	4,771	5,496	725 (526–924)	
Pennsylvania	14,340	19,114	4,774 (4416–5,132)	15,463	19,064	3,601 (3,237–3,965)	*
Rhode Island	1,112	1,423	311 (212–410)	1,210	1,442	232 (131–333)	
South Carolina	5,079	7,063	1,984 (1,768–2,200)	5,846	7,487	1,641 (1,415–1,867)	
South Dakota	856	1,054	198 (112–284)	950	1,115	165 (76–254)	
Tennessee	6,853	10,185	3,332 (3,076–3,588)	7,622	10,694	3,072 (2,807–3,337)	
Texas	22,143	27,141	4,998 (4,563–5,433)	25,469	28,835	3,366 (2,909–3,823)	*
Utah	2,080	1,931	-149 (-273 to -25)	2,413	2,105	-308 (-440 to -176)	
Vermont	723	921	198 (119–277)	807	961	154 (72–236)	
Virginia	8,073	10,162	2,089 (1,824–2,354)	9,090	10,651	1,561 (1,286–1,836)	*
Washington	6,754	8,193	1,439 (1,199–1,679)	7,781	8,427	646 (396–896)	*
West Virginia	2,289	3,415	1,126 (978–1,274)	2,446	3,642	1,196 (1,043–1,349)	
Wisconsin	5,978	7,530	1,552 (1,324–1,780)	6,635	7,652	1,017 (783–1251)	*
Wyoming	585	695	110 (40–180)	651	682	31 (-41–103)	
United States	**316,652**	**400,949**	**84,443 (82,783–86,103)**	**353,645**	**416,182**	**63,209 (61,489–64,929)**	*
Cerebrovascular diseases (stroke)							
Alabama	588	1,277	689 (604–774)	646	1,335	689 (602–776)	
Alaska	62	91	29 (5–53)	72	87	15 (-10–40)	
Arizona	771	848	77 (-2–156)	905	912	7 (-77–91)	
Arkansas	365	718	353 (289–417)	398	738	340 (274–406)	
California	3,839	5,366	1,527 (1,339–1,715)	4,374	5,324	950 (757–1,143)	*
Colorado	520	604	84 (18–150)	614	633	19 (-50–88)	
Connecticut	420	425	5 (-52–62)	460	405	-55 (-113–3)	
Delaware	113	170	57 (24–90)	130	172	42 (8–76)	
District of Columbia	61	107	46 (21–71)	66	88	22 (-2–46)	
Florida	2,655	3,481	826 (672–980)	3,030	3,812	782 (620–944)	
Georgia	989	1,965	976 (869–1,083)	1,150	2,060	910 (799–1,021)	
Hawaii	163	244	81 (41–121)	182	234	52 (12–92)	
Idaho	174	234	60 (20–100)	204	268	64 (21–107)	
Illinois	1,412	2,047	635 (520–750)	1,547	2,175	628 (508–748)	
Indiana	739	1,240	501 (414–588)	816	1,289	473 (383–563)	
Iowa	373	462	89 (32–146)	403	465	62 (4–120)	
Kansas	321	485	164 (108–220)	349	489	140 (83–197)	

See table footnotes on page 1253.

TABLE 2. (*Continued*) Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by state — United States, 2010 and 2014

State	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable (95% CI)	Expected	Observed	Potentially preventable (95% CI)	
Kentucky	520	934	414 (339–489)	573	948	375 (299–451)	
Louisiana	510	1,003	493 (417–569)	564	1,176	612 (530–694)	
Maine	180	229	49 (9–89)	202	222	20 (-20–60)	
Maryland	636	935	299 (221–377)	720	1,025	305 (223–387)	
Massachusetts	761	807	46 (-32–124)	846	784	-62 (-141–17)	
Michigan	1,178	1,743	565 (459–671)	1,306	1,792	486 (377–595)	
Minnesota	592	662	70 (1–139)	669	705	36 (-37–109)	
Mississippi	344	827	483 (416–550)	377	858	481 (412–550)	
Missouri	724	1,164	440 (355–525)	793	1,263	470 (381–559)	
Montana	127	162	35 (2–68)	146	182	36 (1–71)	
Nebraska	209	294	85 (41–129)	227	273	46 (2–90)	
Nevada	305	446	141 (87–195)	361	482	121 (64–178)	
New Hampshire	158	163	5 (-30–40)	181	174	-7 (-44–30)	
New Jersey	1,015	1,319	304 (209–399)	1,111	1,322	211 (114–308)	
New Mexico	246	310	64 (18–110)	275	321	46 (-2–94)	
New York	2,246	2,423	177 (43–311)	2,445	2,394	-51 (-187–85)	
North Carolina	1,108	1,894	786 (679–893)	1,271	2,110	839 (725–953)	
North Dakota	80	127	47 (19–75)	87	120	33 (5–61)	
Ohio	1,400	2,271	871 (752–990)	1,523	2,328	805 (683–927)	
Oklahoma	448	889	441 (369–513)	488	894	406 (333–479)	
Oregon	461	635	174 (109–239)	536	699	163 (94–232)	
Pennsylvania	1,611	2,194	583 (462–704)	1,740	2,388	648 (522–774)	
Rhode Island	123	148	25 (-7–57)	135	114	-21 (-52–10)	
South Carolina	567	1,119	552 (472–632)	661	1,185	524 (440–608)	
South Dakota	97	126	29 (0–58)	107	108	1 (-28–30)	
Tennessee	765	1,463	698 (605–791)	859	1,626	767 (669–865)	
Texas	2,471	4,254	1,783 (1,622–1,944)	2,850	4,620	1,770 (1,601–1,939)	
Utah	238	282	44 (-1–89)	276	325	49 (1–97)	
Vermont	79	91	12 (-14–38)	90	82	-8 (-34–18)	
Virginia	891	1,369	478 (385–571)	1,014	1,354	340 (245–435)	
Washington	743	907	164 (84–244)	867	937	70 (-13–153)	
West Virginia	257	464	207 (154–260)	276	484	208 (154–262)	
Wisconsin	667	869	202 (125–279)	742	854	112 (34–190)	
Wyoming	65	73	8 (-15–31)	73	72	-1 (-25–23)	
United States	**35,390**	**52,360**	**16,973 (16,392–17,554)**	**39,737**	**54,707**	**15,175 (14,573–15,777)**	*
Chronic lower respiratory diseases							
Alabama	765	1,778	1,013 (914–1,112)	848	1,897	1,049 (946–1,152)	
Alaska	77	112	35 (8–62)	92	116	24 (-4–52)	
Arizona	1,004	1,558	554 (455–653)	1,189	1,870	681 (573–789)	
Arkansas	476	1,101	625 (547–703)	523	1,339	816 (731–901)	*
California	4,904	6,047	1,143 (938–1,348)	5,650	6,073	423 (211–635)	*
Colorado	665	1,141	476 (393–559)	795	1,301	506 (416–596)	
Connecticut	544	509	-35 (-99–29)	601	586	-15 (-83–53)	
Delaware	147	224	77 (39–115)	172	231	59 (20–98)	
District of Columbia	78	73	-5 (-29–19)	85	73	-12 (-37–13)	
Florida	3,501	5,327	1,826 (1,642–2,010)	4,018	5,855	1,837 (1,642–2,032)	
Georgia	1,263	2,413	1,150 (1,031–1,269)	1,486	2,729	1,243 (1,116–1,370)	
Hawaii	212	141	-71 (-108 to -34)	239	151	-88 (-127 to -49)	
Idaho	224	409	185 (136–234)	267	485	218 (164–272)	
Illinois	1,815	2,740	925 (793–1,057)	2,010	2,891	881 (744–1,018)	
Indiana	954	2,154	1,200 (1,091–1,309)	1,063	2,389	1,326 (1,211–1,441)	
Iowa	485	859	374 (302–446)	528	968	440 (364–516)	
Kansas	414	826	412 (343–481)	455	938	483 (410–556)	
Kentucky	675	1,792	1,117 (1,020–1,214)	750	2,078	1,328 (1,224–1,432)	*
Louisiana	658	1,106	448 (366–530)	733	1,360	627 (537–717)	*
Maine	237	443	206 (155–257)	268	494	226 (172–280)	
Maryland	818	1,035	217 (133–301)	936	998	62 (-24–148)	
Massachusetts	984	1,115	131 (41–221)	1,105	1,205	100 (6–194)	
Michigan	1,527	2,721	1,194 (1,066–1,322)	1,712	2,939	1,227 (1,093–1,361)	
Minnesota	762	960	198 (117–279)	871	1,153	282 (194–370)	
Mississippi	446	1,016	570 (495–645)	492	1,129	637 (558–716)	
Missouri	941	2,090	1,149 (1,041–1,257)	1,039	2,175	1,136 (1025–1,247)	

See table footnotes on page 1253.

TABLE 2. (*Continued*) Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by state — United States, 2010 and 2014

State	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable (95% CI)	Expected	Observed	Potentially preventable (95% CI)	
Montana	166	341	175 (131–219)	192	380	188 (141–235)	
Nebraska	270	543	273 (217–329)	296	563	267 (210–324)	
Nevada	395	701	306 (241–371)	472	883	411 (339–483)	
New Hampshire	206	315	109 (64–154)	237	352	115 (67–163)	
New Jersey	1,312	1,436	124 (21–227)	1,447	1,391	-56 (-160–48)	
New Mexico	320	535	215 (158–272)	361	605	244 (183–305)	
New York	2,906	3,358	452 (297–607)	3,186	3,306	120 (-38–278)	*
North Carolina	1,436	2,698	1,262 (1,136–1,388)	1,663	3,077	1,414 (1,279–1,549)	
North Dakota	104	170	66 (34–98)	113	162	49 (17–81)	
Ohio	1,818	3,729	1,911 (1,765–2,057)	1,996	3,922	1,926 (1,775–2,077)	
Oklahoma	581	1,736	1,155 (1,061–1,249)	638	1,787	1,149 (1,052–1,246)	
Oregon	599	1,110	511 (430–592)	706	1,153	447 (363–531)	
Pennsylvania	2,101	3,051	950 (809–1,091)	2,287	3,223	936 (791–1,081)	
Rhode Island	160	225	65 (27–103)	176	242	66 (26–106)	
South Carolina	740	1,391	651 (561–741)	870	1,693	823 (724–922)	
South Dakota	126	226	100 (63–137)	140	202	62 (26–98)	
Tennessee	995	2,197	1,202 (1,091–1,313)	1,125	2,567	1,442 (1,323–1,561)	*
Texas	3,139	5,061	1,922 (1,745–2,099)	3,656	5,456	1,800 (1,613–1,987)	
Utah	298	383	85 (34–136)	350	451	101 (46–156)	
Vermont	103	167	64 (32–96)	118	189	71 (37–105)	
Virginia	1,148	1,647	499 (395–603)	1,320	1,714	394 (286–502)	
Washington	956	1,451	495 (399–591)	1,130	1,603	473 (371–575)	
West Virginia	338	921	583 (513–653)	367	995	628 (556–700)	
Wisconsin	862	1,190	328 (239–417)	970	1,375	405 (310–500)	
Wyoming	83	186	103 (71–135)	95	185	90 (57–123)	
United States	**45,738**	**74,458**	**28,831 (28,151–29,511)**	**51,840**	**80,899**	**29,232 (28,518–29,946)**	
Unintentional injuries (accidents)							
Alabama	910	2,036	1,126 (1,020–1,232)	939	2,104	1,165 (1,057–1,273)	
Alaska	131	331	200 (158–242)	137	348	211 (168–254)	
Arizona	1,191	2,341	1,150 (1,034–1,266)	1,284	2,562	1,278 (1,156–1,400)	
Arkansas	551	1,221	670 (587–753)	568	1,172	604 (522–686)	
California	6,886	8,627	1,741 (1,497–1,985)	7,315	9,818	2,503 (2,246–2,760)	*
Colorado	940	1,525	585 (488–682)	1,018	1,833	815 (710–920)	*
Connecticut	679	905	226 (148–304)	696	1,142	446 (362–530)	*
Delaware	172	296	124 (82–166)	183	350	167 (122–212)	
District of Columbia	117	169	52 (19–85)	128	177	49 (15–83)	
Florida	3,675	6,927	3,252 (3,050–3,454)	3,951	6,997	3,046 (2,841–3,251)	
Georgia	1,791	3,133	1,342 (1,204–1,480)	1,905	3,342	1,437 (1,295–1,579)	
Hawaii	259	344	85 (37–133)	272	356	84 (35–133)	
Idaho	285	516	231 (176–286)	304	575	271 (213–329)	
Illinois	2,395	3,093	698 (553–843)	2,449	3,642	1,193 (1,040–1,346)	*
Indiana	1,209	2,064	855 (743–967)	1,250	2,425	1,175 (1,056–1,294)	*
Iowa	571	892	321 (246–396)	587	948	361 (284–438)	
Kansas	525	1,010	485 (408–562)	539	1,004	465 (388–542)	
Kentucky	826	2,240	1,414 (1,305–1,523)	852	2,225	1,373 (1,264–1,482)	
Louisiana	850	1,771	921 (821–1,021)	882	2,074	1,192 (1,085–1,299)	*
Maine	262	390	128 (78–178)	267	487	220 (166–274)	
Maryland	1,093	1,065	-28 (-119–63)	1,147	1,217	70 (-25–165)	
Massachusetts	1,252	1,507	255 (152–358)	1,310	2,085	775 (661–889)	*
Michigan	1,869	2,923	1,054 (918–1,190)	1,916	3,455	1,539 (1,395–1,683)	*
Minnesota	993	1,342	349 (254–444)	1,034	1,440	406 (309–503)	
Mississippi	553	1,395	842 (756–928)	567	1,438	871 (783–959)	
Missouri	1,133	2,328	1,195 (1,080–1,310)	1,164	2,414	1,250 (1,133–1,367)	
Montana	190	416	226 (178–274)	199	418	219 (170–268)	
Nebraska	337	490	153 (97–209)	349	535	186 (128–244)	
Nevada	510	952	442 (367–517)	549	1,032	483 (405–561)	
New Hampshire	255	381	126 (77–175)	263	507	244 (190–298)	*
New Jersey	1,665	1,888	223 (106–340)	1,718	2,309	591 (467–715)	*
New Mexico	386	1,013	627 (554–700)	397	1,249	852 (772–932)	*
New York	3,692	3,804	112 (-58–282)	3,813	4,515	702 (523–881)	*
North Carolina	1,802	3,268	1,466 (1,326–1,606)	1,915	3,592	1,677 (1,532–1,822)	
North Dakota	127	193	66 (31–101)	138	233	95 (57–133)	

See table footnotes on the next page.

TABLE 2. (*Continued*) Number of expected, observed, and potentially preventable deaths among the five leading causes of death and significant changes in potentially preventable deaths, for persons aged <80 years, by state — United States, 2010 and 2014

State	2010			2014			Z-test significance
	Expected	Observed	Potentially preventable (95% CI)	Expected	Observed	Potentially preventable (95% CI)	
Ohio	2,184	4,016	1,832 (1,678–1,986)	2,230	4,928	2,698 (2,532–2,864)	*
Oklahoma	703	1,870	1,167 (1,068–1,266)	732	1,944	1,212 (1,111–1,313)	
Oregon	730	1,068	338 (255–421)	773	1,254	481 (393–569)	
Pennsylvania	2,435	4,319	1,884 (1,723–2,045)	2,486	4,993	2,507 (2,337–2,677)	*
Rhode Island	200	339	139 (93–185)	205	408	203 (154–252)	
South Carolina	883	1,910	1,027 (923–1,131)	942	2,032	1,090 (983–1,197)	
South Dakota	151	284	133 (92–174)	159	320	161 (118–204)	
Tennessee	1,209	2,895	1,686 (1,560–1,812)	1,268	3,059	1,791 (1,662–1,920)	
Texas	4,551	7,612	3,061 (2,845–3,277)	4,951	8,159	3,208 (2,984–3,432)	
Utah	470	765	295 (226–364)	510	927	417 (343–491)	
Vermont	122	181	59 (25–93)	125	188	63 (28–98)	
Virginia	1,521	1,889	368 (254–482)	1,604	2,390	786 (662–910)	*
Washington	1,269	1,925	656 (545–767)	1,355	2,181	826 (709–943)	
West Virginia	364	1,031	667 (594–740)	368	1,134	766 (690–842)	
Wisconsin	1,074	1,666	592 (489–695)	1,105	2,008	903 (794–1,012)	*
Wyoming	106	296	190 (151–229)	111	315	204 (164–244)	
United States	**58,055**	**94,862**	**36,836 (36,070–37,602)**	**60,929**	**106,260**	**45,331 (44,530–46,132)**	*

Abbreviation: CI = confidence interval.
* Significant change from 2010 to 2014, p<0.01.
† Negative potentially preventable deaths occurred when a U.S. Department of Health and Human Services region included one or more of the states with the lowest three death rates (the lowest three death rates were averaged to create the benchmark death rates) for at least a few age groups. Negative potentially preventable deaths were preserved in this table to test changes from 2010 to 2014, but were truncated to zero and not included in the totals for the United States in the table and text.

increased for each of the five leading causes of deaths in 2014, and age-adjusted death rates declined during 2010–2014 for each category except unintentional injuries. Specifically, from 2010 to 2014, age-adjusted death rates per 100,000 population for heart disease declined 6.8% from 179.1 to 167.0; for cancer, from 172.8 to 161.2 (6.7% decrease); for stroke, from 39.1 to 36.5 (6.6% decrease); and for CLRD, from 42.2 to 40.5 (4.0% decrease). For unintentional injuries, age-adjusted death rates increased 6.6%, from 38.0 to 40.5 (supplemental material at https://stacks.cdc.gov/view/cdc/42341) (*1*). Among subcategories of unintentional injury deaths for all ages, age-adjusted death rates for poisonings increased 25%, and falls increased by 12% (supplemental material at https://stacks.cdc.gov/view/cdc/42344). Prescription drug and illicit drug overdose was a major contributor to the increase in poisonings during 2010–2014 (*4*).

Discussion

The results of this analysis show that the number of observed deaths increased for each of the leading five causes of death, consistent with increases in population size in 2014, compared with 2010. Age-adjusted death rates declined overall for all causes of death combined in 2014 compared with 2010. Potentially preventable deaths declined during 2010–2014 for three of the five leading causes of death: diseases of the heart, cancer, and stroke. No change was observed for potentially preventable deaths from CLRD. Potentially preventable deaths from unintentional injuries increased from 2010 compared with 2014.

States in the Southeast continued to have the highest number of potentially preventable deaths from all five causes in 2014.

Although substantial progress was made in combatting infectious diseases during the early part of the 20th century, additional focus has shifted toward prevention of noncommunicable diseases, including chronic diseases, and unintentional injuries (*5,6*). The decrease in cancer deaths can be attributed, in part, to progress in prevention, early detection, and treatment (*7*). Improvement of quality of care and reduction in risk factors, including increased number of persons with hypertension under control, have contributed to the decline in death rates for heart disease and stroke.** Tobacco use is a risk factor for some of the deaths included in this report, such as heart disease, cancer, CLRD, and cerebrovascular diseases.†† Mortality from tobacco-related causes has decreased in conjunction with national decreases in tobacco use across the United States, but an estimated 40 million adults (16.8%) smoked in 2014 (*8*). Implementation of evidence-based tobacco control interventions, including increased tobacco product prices, implementation and enforcement of comprehensive smoke-free laws, media campaigns, and access to proven resources (e.g., quit lines) to help persons quit tobacco use§§ varies among states. In addition to tobacco use, other health behaviors contribute to premature deaths and create opportunities for prevention. For example,

** http://www.cdc.gov/nchs/data/databriefs/db220.pdf.
†† http://www.surgeongeneral.gov/library/reports/50-years-of-progress/.
§§ http://www.cdc.gov/tobacco/stateandcommunity/best_practices/index.htm.

obesity increases the risk for CLRD, diseases of the heart, and cerebrovascular disease, in addition to some cancers.¶¶

Although the number of potentially preventable deaths declined during 2010–2014 for heart disease, cancer, and stroke, observed deaths increased overall for these causes. Based on the methodology used for this analysis, when the pace of the increase in observed deaths is slower than the growth in population, potentially preventable deaths will decrease. Observed deaths increased 6% for heart disease, 4% for cancer, 4% for stroke, and 8% for CLRD. These increases were smaller than would be expected to result from population growth, particularly growth in population size among older age groups during this period.

In contrast, both observed and potentially preventable deaths from unintentional injuries increased during 2010–2014. Examples of state actions to reduce drug overdose include developing or enhancing prescription drug monitoring programs, adopting clinical prescribing guidelines, and increasing access to medication-assisted treatment for opioid use disorder and naloxone to reverse opioid-related poisoning (9). As the U.S. population aged, falls among older adults increased. Tools such as STEADI, designed to assist clinicians in assessing fall risk, educating patients, and selecting interventions, are available from CDC.***

The findings in this report are subject to at least five limitations. First, the same method used in a previous report was applied to set a benchmark for potentially preventable deaths (2). These benchmarks are based on data from the states with the lowest death rates for each condition during 2008–2010 alone. The benchmarks might need to be reevaluated over time, especially given shifts in cause-specific death rates observed using provisional mortality data from 2015–2016.††† For example, death rates from unintentional injury were increasing before 2008–2010, resulting in benchmarks that might not be comparable to historical lows or international points of reference. Second, alternative ways of defining and measuring potentially preventable or premature avoidable mortality have been used in other studies and no gold standard exists (10). Third, a lowest average rate was calculated based on individual states. The sum of the individual potentially preventable deaths by state is qualitatively different from estimating the number of potentially preventable deaths for the United States as a whole. Fourth, changes in the number of potentially preventable deaths by cause are not necessarily independent. For example, whereas some cancer deaths might be prevented entirely, some might be shifted into another cause grouping, such as heart

Summary

What is already known about this topic?

Deaths from heart disease, cancer, chronic lower respiratory disease, cerebrovascular diseases (stroke), and unintentional injuries account for the five leading causes of death in the United States. Death rates for these diseases vary widely across states, related to variation in the distribution of social determinants of health, access and use of health services, and public health efforts.

What is added by this report?

There has been a significant decrease in the number of potentially preventable deaths among three of the five leading causes of death (diseases of the heart, cancer, and stroke) during 2010–2014. However, the number of potentially preventable deaths from unintentional injuries increased significantly during the same period. This is mostly attributed to an increase in drug poisoning (overdose from prescription and illicit drugs) and falls. No significant change was observed in potentially preventable deaths from chronic lower respiratory disease (e.g., asthma, bronchitis, and emphysema).

What are the implications for public health practice?

Public health officials can use the decreases observed as benchmarks for improving population health, while using observed increases to direct targeted efforts to reduce the number of potentially preventable deaths. A joint effort of public health and health care organizations can support analysis and action to reduce the number of potentially preventable deaths from the five leading causes of death. Specifically, given the reported increase in potentially preventable deaths from unintentional injuries, these findings might inform the selection and implementation of evidence-based interventions to prevent deaths from injuries such as falls and drug overdoses, based on epidemiologic burden.

disease. Finally, defining potentially preventable deaths across the five leading causes does not take into consideration the fact that these are complex and diverse causes of death. Not all deaths are equivalently preventable across the leading causes or within each leading cause. For example, certain types of cancer might be considered more or less preventable than other types, and some specific mechanisms of injury deaths (e.g., drug poisoning) might be considered completely preventable and other mechanisms less preventable. In addition, the majority of risk factors do not occur randomly in populations; they are closely related to the social, demographic, environmental, economic, and geographic attributes of the neighborhoods in which persons live and work.§§§ However, from a health equity perspective, every state can be compared with the same benchmark rates regardless of demographic differences. If health disparities were eliminated, as is called for by *Healthy People 2020*,¶¶¶ all

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¶¶ http://www.nhlbi.nih.gov/sites/www.nhlbi.nih.gov/files/obesity-evidence-review.pdf.
*** http://www.cdc.gov/steadi/pdf/stay_independent_brochure-a.pdf.
††† http://www.cdc.gov/nchs/products/vsrr/mortality-dashboard.htm.

§§§ http://www.cdc.gov/mmwr/preview/ind2013_su.html.
¶¶¶ https://www.healthypeople.gov/.

states could be closer to achieving the lowest possible death rates for the five leading causes of death.

Further analysis of state and regional differences in death rates for the five leading causes of death could assist state and federal health officials in establishing prevention goals, priorities, and strategies. Clinical preventive services, including physician tobacco cessation counseling, as recommended by the U.S. Preventive Services Task Force**** for heart disease, stroke, cancer, and CLRD also provide opportunities for addressing preventable deaths.[††††]

**** https://www.uspreventiveservicestaskforce.org/Page/Name/uspstf-a-and-b-recommendations/.
†††† https://www.uspreventiveservicestaskforce.org/Page/Name/tools-and-resources-for-better-preventive-care.

[1]Center for Surveillance, Epidemiology, and Laboratory Services, CDC; [2]National Center for Health Statistics, CDC; [3]National Center for Injury Prevention and Control, CDC; [4]National Center for Chronic Disease Prevention and Health Promotion, CDC.

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