Cancer Deaths: A Comparison of Age-Adjustment Methods in a State Health Scorecard

Kristin Shaw, MPH, Elise Parks, MPH, Mary Ann Honors, PhD, MPH, Laura Houghtaling, MPH, Sarah Milder, MPH and Thomas Eckstein, MBA

Arundel Metrics, Incorporated, Saint Paul, MN

Background

America's Health Rankings is the longest running annual assessment of state health. Cancer deaths has been in the rankings since the first report in 1990.

When reporting cancer death rates, it is important to control for age as it is a major risk factor. *America's Health Rankings* uses a non-standard age-adjustment method, a 3-year estimate age-adjusted to the mid-year population. This method adjusts estimates to the age distribution for the U.S. mid-year population, allowing comparison between states but not over time.

We explore the effect of age-adjustment method on the relative comparison of cancer deaths by state and the ability to assess long-term trends in this key mortality measure.

Methodology

Cancer mortality rates were calculated for all 50 states, the District of Columbia and the nation using CDC WONDER Compressed Mortality files: 1979-1998 (ICD-9 codes) and 1999-2016 (ICD-10 codes) to obtain 3-year estimates for 1990 (data years 1986-88) and 2019 (data years 2014-2016) time points, respectively.

- ICD-10: C00-C97, D00-D09, and D37-D48. Excludes D10-D36 (Benign neoplasms).
- ICD-9: 140-149, 150-159, 160-165, 170-175, 179-189, 190-199, 200-208, 230-234, 235-238 and 239-239. Excludes 2010-229 (Benign neoplasms).

Rates age-adjusted to the 2000 U.S. Standard Population and non-standard rates adjusted to the mid-year population were calculated.

State ranks, graphs and a quintile heat map were generated using Excel.

Results

2019 relative comparison of methods
- 4 states moved quintiles: South Dakota, Maryland, Vermont and Iowa
- Ranks changed by +/-2 in 2 states, +/-1 in 9 states, and 39 states (78%) had no rank change between methods

1990: Relative comparison of methods
- 4 states moved quintiles: California, Massachusetts, New Hampshire and Rhode Island
- Ranks changed by +/-2 in 9 states, +/-1 in 7 states and 34 states (68%) had no rank change between methods

1990 to 2019: Relative comparison of methods across time periods
- States that moved to a healthier quintile using mid-year method saw similar improvements using standard method and vice versa, with exception of Vermont
- Vermont dropped from the 3rd quintile to the 4th quintile based on the standard method

Number of cancer deaths per 100,000 population, shaded by quintile and sorted by 2019 mid-year age-adjusted estimate
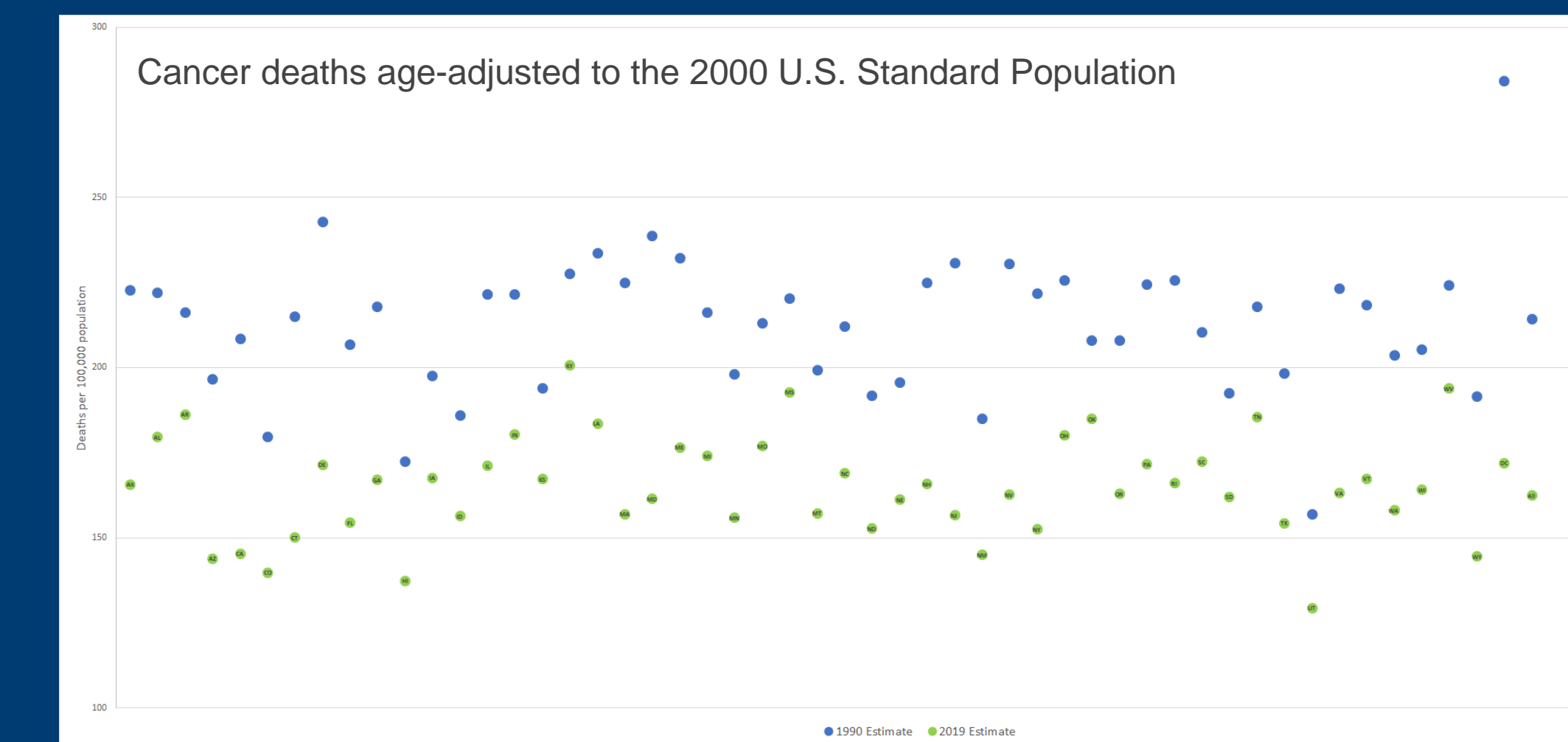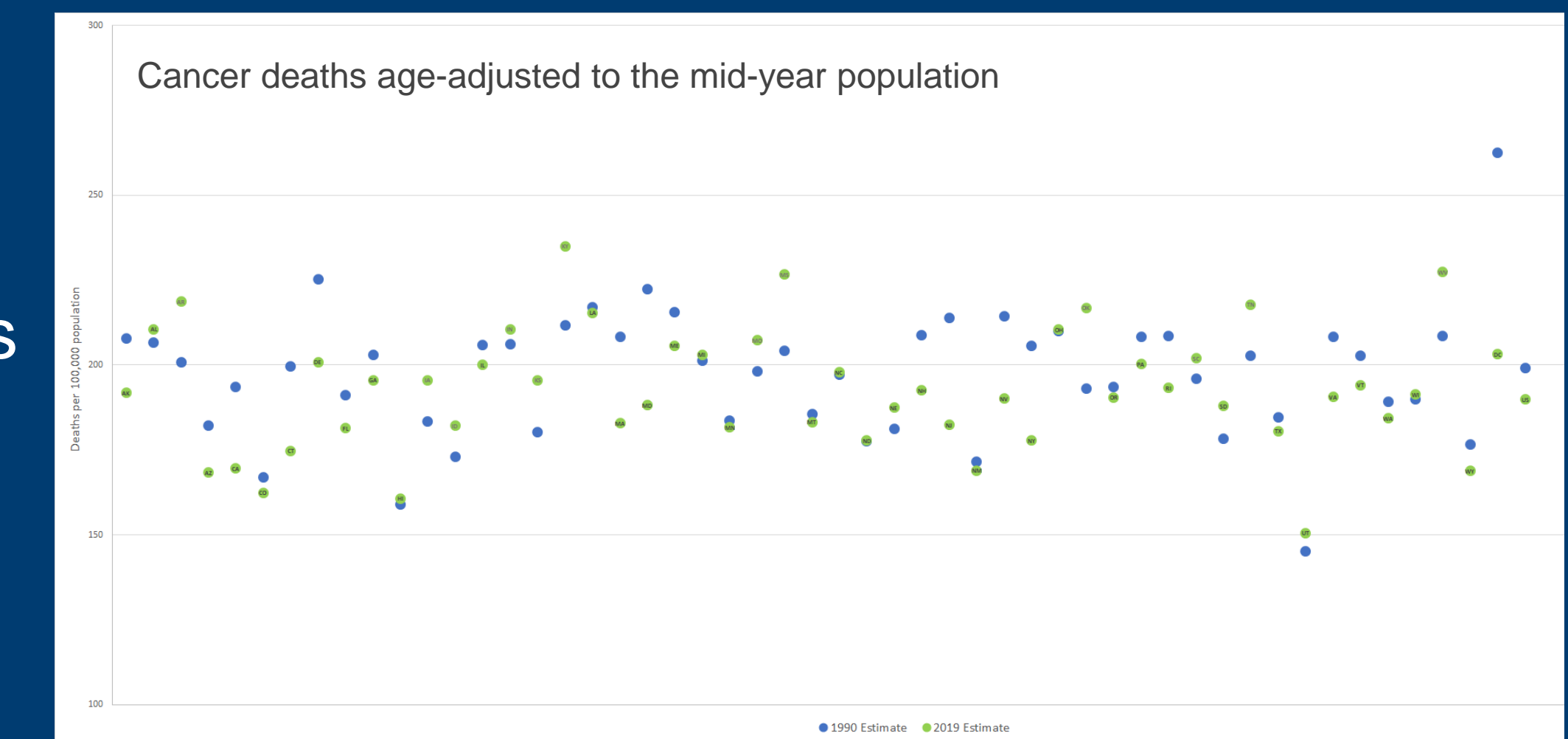
States	2019 Estimate		1990 Estimate	
	Mid-Year	2000 Standard	Mid-Year	2000 Standard
Utah	150.6	129.4	145.1	156.8
Hawaii	160.7	137.4	159.0	172.5
Colorado	162.4	139.8	167.0	179.7
Arizona	168.4	143.9	182.2	196.5
Wyoming	168.8	144.5	176.7	191.5
New Mexico	169.0	145.1	171.5	185.0
California	169.5	145.4	193.6	208.5
Connecticut	174.8	150.1	199.7	214.9
New York	177.8	152.5	205.6	221.7
North Dakota	177.8	152.8	177.7	191.7
Texas	180.6	154.3	184.6	198.4
Florida	181.4	154.5	191.1	206.8
Minnesota	181.6	155.9	183.6	198.1
Idaho	182.2	156.4	173.0	186.0
New Jersey	182.4	156.6	213.9	230.8
Massachusetts	182.8	157.0	208.4	225.0
Montana	183.2	157.2	185.6	199.2
Washington	184.3	158.1	189.3	203.5
Nebraska	187.5	161.2	181.2	195.6
South Dakota	188.0	162.1	178.4	192.4
Maryland	188.2	161.4	222.4	238.8
Nevada	190.1	162.7	214.4	230.5
Oregon	190.5	163.0	193.6	208.0
Virginia	190.6	163.1	208.2	223.2
Wisconsin	191.3	164.2	189.9	205.3
Alaska	191.8	165.7	207.8	222.7
New Hampshire	192.5	165.8	208.8	224.9
Rhode Island	193.3	166.0	208.6	225.5
Vermont	194.1	167.4	202.7	218.3
Georgia	195.6	167.1	203.1	218.0
Iowa	195.6	167.6	183.4	197.5
Kansas	195.6	167.3	180.2	193.9
North Carolina	197.9	168.9	197.1	212.0
Illinois	200.1	171.2	205.8	221.5
Pennsylvania	200.3	171.7	208.2	224.3
Delaware	200.9	171.5	225.3	242.8
South Carolina	202.0	172.3	195.9	210.5
Michigan	203.1	174.0	201.3	216.3
Maine	205.7	176.6	215.5	232.2
Missouri	207.3	176.9	198.2	213.0
Ohio	210.4	180.1	210.0	225.7
Alabama	210.6	179.6	206.7	222.0
Indiana	210.6	180.3	206.1	221.5
Louisiana	215.4	183.6	217.0	233.5
Oklahoma	216.9	184.9	193.1	208.0
Tennessee	217.8	185.5	202.8	218.0
Arkansas	218.7	186.3	200.9	216.3
Mississippi	226.7	192.8	204.1	220.4
West Virginia	227.4	193.9	208.6	224.2
Kentucky	235.0	200.6	211.6	227.5
United States	189.9	162.5	199.0	214.3
District of Columbia	203.2	172.0	262.4	284.2

More healthy ▢▢▢▢▢ Less healthy

Results

Cancer death rates increased in 12 states and decreased in 19 states and D.C. over the 30-year period using the mid-year age-adjustment method.

When using the 2000 standard age-adjustment method, cancer death rates decreased in all 50 states and D.C.

Cancer deaths age-adjusted to the mid-year population

Cancer deaths age-adjusted to the 2000 U.S. Standard Population

Blue dots represent the 1990 estimate and green dots the 2019 estimate.

Conclusions

- Relative comparison of standard and non-standard methods produced little difference in state quintiles and ranks in 1990 and in 2019, as well as over time.
- State trends over the 30-year period, however, differed based on the method of age-adjustment used.
- Using a non-standard age-adjusted death rate allows *America's Health Rankings* to compare cancer deaths across states, while maintaining a more current age profile of the population.
- *America's Health Rankings* should present age-adjusted death rates to the 2000 U.S. Standard Population alongside the mid-year rate to evaluate long-term trends. In addition, crude rates would provide insight into the current cancer death burden in a state.

Limitations

- Rates do not reflect the ICD-9 to ICD-10 comparability ratio (1.0068); this could have a small impact on the rates.
- Rates were calculated using 3 years of data to account for states with small populations; an approach that may not be as relevant today as it was in 1990.

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