Excess Deaths From COVID-19 and Other Causes, March-April 2020

The number of publicly reported deaths from coronavirus disease 2019 (COVID-19) may underestimate the pandemic's death toll. Such estimates rely on provisional data that are often incomplete and may omit undocumented deaths from COVID-19. Moreover, restrictions imposed by the pandemic (eg, stay-at-home orders) could claim lives indirectly through delayed care for acute emergencies, exacerbations of chronic diseases, and psychological distress (eg, drug overdoses). This study estimated excess deaths in the early weeks of the pandemic and the relative contribution of COVID-19 and other causes.

Editorial page 458

Author Audio Interview

Supplemental content

Related articles at
jamainternalmedicine.com
jamahealthforum.com

Methods | Weekly death data for the 50 US states and the District of Columbia were obtained from the National Center for Health Statistics for January through April 2020 and the preceding 6 years (2014-2019).[1,2] US totals excluded Connecticut and North Carolina because of missing data. The analysis included total deaths and deaths from COVID-19, influenza/pneumonia, heart disease, diabetes, and 10 other grouped causes (Supplement). Mortality rates for causes other than COVID-19 were available only for underlying causes. Death data with any mention of COVID-19 on the death certificate (as an underlying or contributing cause) were used to capture all deaths attributed to the virus. Population counts for calculating mortality rates were obtained from the US Census Bureau.[3,4]

Observed deaths for the 8 weeks between March 1, 2020, and April 25, 2020, were taken from provisional data released on June 10, 2020.[2] Expected deaths (and 95% CIs) for these same weeks were estimated by fitting a hierarchical Poisson regression model to the weekly death counts for the period of December 29, 2013, through February 29, 2020 (assembled from final data for 2014-2018[1] and provisional data for January 1, 2019, through February 29, 2020[2]). The model with the optimal fit (Supplement) used a combination of harmonic functions to capture seasonality and adjusted for annual trends with a categorical year effect. The model allowed season and time trends to vary by state.

Excess deaths equaled the difference between observed and expected deaths and were summed across the 8 weeks to estimate total excess deaths. To explore increases in cause-specific mortality in jurisdictions overwhelmed by COVID-19, mortality trends for 14 grouped causes (4 reported here) were examined in the 5 states with the most COVID-19 deaths from March through April 2020 (Massachusetts, Michigan, New Jersey, New York, and Pennsylvania). Deaths in these states peaked in the week ending on April 11, 2020, and the proportional increase above baseline (weighted mean of weekly deaths over 9 weeks in January to February 2020) was measured. All calculations were performed using SAS, version 9.4 (SAS Institute Inc).

Results | Between March 1, 2020, and April 25, 2020, a total of 505 059 deaths were reported in the US; 87 001 (95% CI, 86 578-87 423) were excess deaths, of which 56 246 (65%) were attributed to COVID-19. In 14 states, more than 50% of excess deaths were attributed to underlying causes other than COVID-19; these included California (55% of excess deaths) and Texas (64% of excess deaths) (**Table**). The 5 states with the most COVID-19 deaths experienced large proportional increases in deaths due to nonrespiratory underlying causes, including diabetes (96%), heart diseases (89%), Alzheimer disease (64%), and cerebrovascular diseases (35%) (**Figure**). New York City experienced the largest increases in nonrespiratory deaths, notably those due to heart disease (398%) and diabetes (356%).

Discussion | These estimates suggest that the number of COVID-19 deaths reported in the first weeks of the pandemic captured only two-thirds of excess deaths in the US. Potential explanations include delayed reporting of COVID-19 deaths and misattribution of COVID-19 deaths to

Table. Excess Deaths From March 1, 2020, to April 25, 2020, Attributed and Not Attributed to Coronavirus Disease 2019 (COVID-19)[a]

Jurisdiction	Expected deaths, No. (95% CI)[b]	Observed deaths, No.	Excess deaths, No. (95% CI)	COVID-19 deaths[c]		Deaths not attributed to COVID-19[c]	
				Reported deaths, No.	Excess deaths, %	Excess deaths, No. (95% CI)	Excess deaths, %
United States[d]	419 058 (418 636 to 419 481)	505 059	87 001 (86 578 to 87 423)	56 246	65	30 755 (30 332 to 31 177)	35
Jurisdictions with highest COVID-19 death counts[c]							
New York City	8369 (8310 to 8427)	29 703	21 334 (21 276 to 21 393)	14 952	70	6382 (6324 to 6441)	30
New Jersey	11 458 (11 388 to 11 528)	23 174	11 716 (11 646 to 11 786)	8037	69	3679 (3609 to 3749)	31
New York (excluding New York City)	15 603 (15 519 to 15 686)	24 611	9008 (8925 to 9092)	6569	73	2439 (2356 to 2523)	27
Michigan	15 217 (15 134 to 15 300)	20 232	5015 (4932 to 5098)	3372	67	1643 (1560 to 1726)	33
Massachusetts	9316 (9253 to 9378)	13 412	4096 (4034 to 4159)	3122	76	974 (912 to 1037)	24
Pennsylvania	17 178 (17 089 to 17 268)	22 304	5126 (5036 to 5215)	2752	54	2374 (2284 to 2463)	46

(continued)

Table. Excess Deaths From March 1, 2020, to April 25, 2020, Attributed and Not Attributed to Coronavirus Disease 2019 (COVID-19)[a] (continued)

Jurisdiction	Expected deaths, No. (95% CI)[b]	Observed deaths, No.	Excess deaths, No. (95% CI)	COVID-19 deaths[c]		Deaths not attributed to COVID-19[c]	
				Reported deaths, No.	Excess deaths, %	Excess deaths, No. (95% CI)	Excess deaths, %
Other jurisdictions							
Illinois	16 559 (16 473 to 16 646)	20 310	3751 (3664 to 3837)	2051	55	1700 (1613 to 1786)	45
California	42 263 (42 121 to 42 405)	46 289	4026 (3884 to 4168)	1801	45	2225 (2083 to 2367)	55
Louisiana	7097 (7044 to 7150)	9082	1985 (1932 to 2038)	1594	80	391 (338 to 444)	20
Florida	33 550 (33 421 to 33 678)	35 766	2216 (2088 to 2345)	1250	56	966 (838 to 1095)	44
Indiana	10 459 (10 392 to 10 525)	11 672	1213 (1147 to 1280)	997	82	216 (150 to 283)	18
Maryland	7664 (7608 to 7719)	9561	1897 (1842 to 1953)	979	52	918 (863 to 974)	48
Georgia	13 205 (13 128 to 13 281)	14 576	1371 (1295 to 1448)	973	71	398 (322 to 475)	29
Colorado	6374 (6323 to 6424)	7573	1199 (1149 to 1250)	822	69	377 (327 to 428)	31
Texas	31 398 (31 277 to 31 520)	33 672	2274 (2152 to 2395)	809	36	1465 (1343 to 1586)	64
Ohio	18 752 (18 660 to 18 844)	19 387	635 (543 to 727)	794	125	−159 (−251 to −67)	−25
Washington	8849 (8789 to 8910)	9882	1033 (972 to 1093)	719	70	314 (253 to 374)	30
Virginia	10 679 (10 612 to 10 747)	12 045	1366 (1298 to 1433)	526	39	840 (772 to 907)	61
Arizona	9777 (9713 to 9842)	10 734	957 (892 to 1021)	365	38	592 (527 to 656)	62
Missouri	9985 (9920 to 10 050)	10 504	519 (454 to 584)	335	65	184 (119 to 249)	35
Alabama	8079 (8022 to 8136)	8631	552 (495 to 609)	317	57	235 (178 to 292)	43
Wisconsin	8448 (8388 to 8508)	9013	565 (505 to 625)	288	51	277 (217 to 337)	49
Minnesota	7088 (7035 to 7142)	7384	296 (242 to 349)	287	97	9 (−45 to 62)	3
Mississippi	4832 (4790 to 4873)	5403	571 (530 to 613)	252	44	319 (278 to 361)	56
Rhode Island	1641 (1621 to 1661)	1870	229 (209 to 249)	250	109	−21 (−41 to −1)	−9
Kentucky	7451 (7396 to 7505)	7621	170 (116 to 225)	215	126	−45 (−99 to 10)	−26
South Carolina	7786 (7729 to 7842)	8561	775 (719 to 832)	213	27	562 (506 to 619)	73
Nevada	4090 (4052 to 4127)	4328	238 (201 to 276)	213	89	25 (−12 to 63)	11
Oklahoma	5824 (5777 to 5871)	6285	461 (414 to 508)	193	42	268 (221 to 315)	58
District of Columbia	947 (934 to 960)	1223	276 (263 to 289)	185	67	91 (78 to 104)	33
Tennessee	11 604 (11 534 to 11 675)	12 224	620 (549 to 690)	172	28	448 (377 to 518)	72
Iowa	4741 (4699 to 4782)	4815	74 (33 to 116)	122	164	−48 (−89 to −6)	−64
Oregon	5684 (5638 to 5731)	6101	417 (370 to 463)	114	27	303 (256 to 349)	73
Delaware	1409 (1391 to 1427)	1623	214 (196 to 232)	113	53	101 (83 to 119)	47
Kansas	4133 (4095 to 4170)	4254	121 (84 to 159)	104	86	17 (−20 to 55)	14
New Mexico	2896 (2866 to 2926)	2969	73 (43 to 103)	89	121	−16 (−46 to 14)	−21
New Hampshire	1894 (1872 to 1916)	2044	150 (128 to 172)	61	41	89 (67 to 111)	59
Nebraska	2615 (2587 to 2643)	2715	100 (72 to 128)	51	51	49 (21 to 77)	49
Idaho	2202 (2177 to 2227)	2321	119 (94 to 144)	46	39	73 (48 to 98)	61
Maine	2347 (2321 to 2373)	2368	21 (−5 to 47)	41	195	−20 (−46 to 6)	−95
Arkansas	4973 (4930 to 5015)	5051	78 (36 to 121)	37	47	41 (−1 to 84)	53
West Virginia	3535 (3500 to 3569)	3538	3 (−31 to 38)	27	777	−24 (−58 to 11)	−677
Utah	2952 (2921 to 2982)	3182	230 (200 to 261)	26	11	204 (174 to 235)	89
Vermont	903 (890 to 916)	1018	115 (102 to 128)	11	10	104 (91 to 117)	90
Wyoming	718 (708 to 729)	782	64 (53 to 74)	0	0	64 (53 to 74)	100
South Dakota	1268 (1251 to 1284)	1306	38 (22 to 55)	0	0	38 (22 to 55)	100
Montana	1614 (1594 to 1634)	1637	23 (3 to 43)	0	0	23 (3 to 43)	100

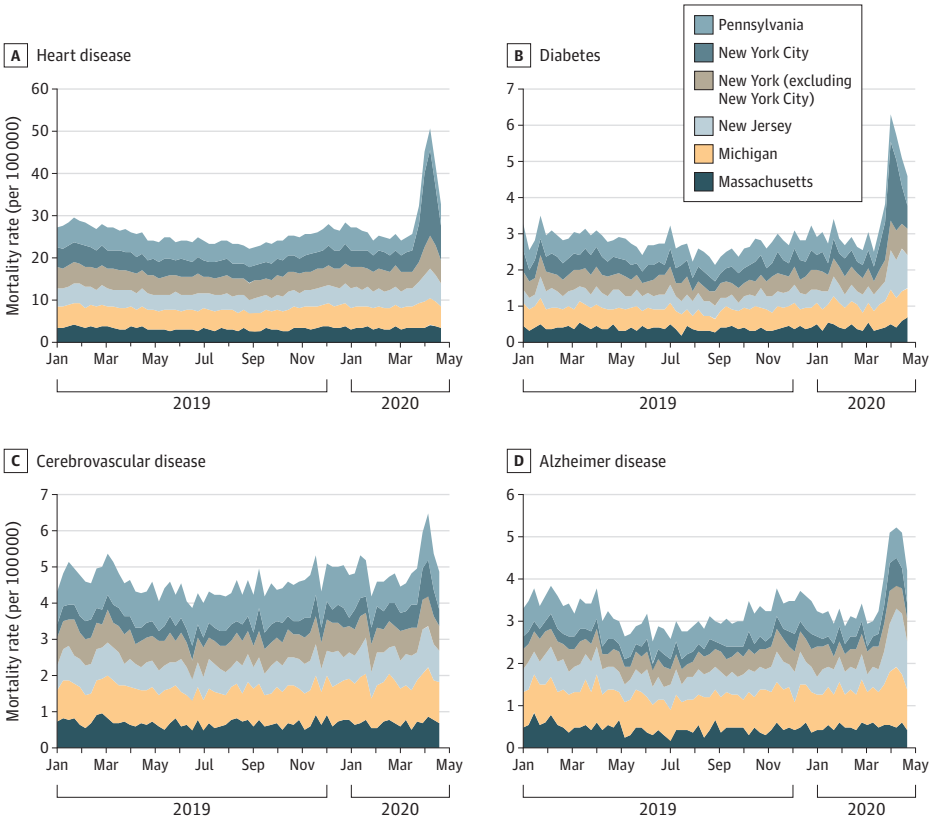
[a] Data were not applicable (and not shown) for states with "negative" excess deaths (COVID-19 deaths exceeding projected deaths), including Alaska (−45 deaths), Hawaii (−45 deaths), and North Dakota (−244 deaths).

[b] Seasonal average predicted by regression model.

[c] COVID-19 deaths include deaths in which COVID-19 was identified as the underlying cause of death or a contributing cause.

[d] The US total was calculated as the sum of results for 48 states and the District of Columbia. Data for Connecticut and North Carolina were omitted because of delays in reporting.

Figure. Weekly Death Rates From January 2019 Through April 2020



Data refer only to underlying causes of death; COVID-19 may have been a contributing cause in an unknown number of deaths. New Jersey and New York City experienced the largest relative increases.

other respiratory illnesses (eg, pneumonia) or to nonrespiratory causes reflecting complications of COVID-19 (eg, coagulopathy, myocarditis). Few excess deaths involved pneumonia or influenza as underlying causes.

This study has limitations, including the reliance on provisional data, potentially inaccurate death certificates, and modeling assumptions. For example, modeling epidemiologic years instead of calendar years would reduce the excess deaths estimate to 73 524.

Large increases in mortality from heart disease, diabetes, and other diseases were observed. Further investigation is required to determine the extent to which these trends represent nonrespiratory manifestations of COVID-19 or secondary pandemic mortality caused by disruptions in society that diminished or delayed access to health care and the social determinants of health (eg, jobs, income, food security).

Steven H. Woolf, MD, MPH
Derek A. Chapman, PhD
Roy T. Sabo, PhD
Daniel M. Weinberger, PhD
Latoya Hill, MPH

Author Affiliations: Center on Society and Health, Virginia Commonwealth University School of Medicine, Richmond (Woolf, Chapman, Hill); Department of Biostatistics, Virginia Commonwealth University School of Medicine, Richmond (Sabo); Department of Epidemiology of Microbial Diseases, Yale School of Public Health, New Haven, Connecticut (Weinberger).

Corresponding Author: Steven H. Woolf, MD, MPH, Center on Society and Health, Virginia Commonwealth University School of Medicine, 830 E Main St, Ste 5035, Richmond, VA 23298-0212 (steven.woolf@vcuhealth.org).

Accepted for Publication: June 16, 2020.

Published Online: July 1, 2020. doi:10.1001/jama.2020.11787

Author Contributions: Drs Woolf and Chapman had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Woolf, Chapman, Sabo, Weinberger.
Acquisition, analysis, or interpretation of data: Chapman, Sabo, Hill.
Drafting of the manuscript: Woolf, Chapman, Sabo, Weinberger.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Chapman, Sabo, Weinberger, Hill.
Administrative, technical, or material support: Woolf, Chapman.
Supervision: Woolf.

Conflict of Interest Disclosures: Dr Weinberger reported receiving grants from Pfizer and the National Institute of Allergy and Infectious Diseases (R01AI137093) and personal fees from Pfizer, Merck, GlaxoSmithKline, and Affinivax outside the submitted work. No other disclosures were reported.

Funding/Support: This study was partially funded by the National Center for Advancing Translational Sciences (grant UL1TR002649).

Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

1. Weekly counts of deaths by state and select causes, 2014-2018. National Center for Health Statistics website. Updated June 5, 2020. Accessed June 10, 2020. https://data.cdc.gov/NCHS/Weekly-Counts-of-Deaths-by-State-and-Select-Causes/3yf8-kanr

2. Weekly counts of deaths by state and select causes, 2019-2020. National Center for Health Statistics website. Updated June 10, 2020. Accessed June 10,

2020. https://data.cdc.gov/NCHS/Weekly-Counts-of-Deaths-by-State-and-Select-Causes/muzy-jte6

3. 2018 American Community Survey 1-year estimates: table B01003. US Census Bureau website. Accessed May 15, 2020. https://data.census.gov/cedsci/table?hidePreview=false&tid=ACSDT1Y2018.B01003&t=Total%20population&vintage=2018

4. QuickFacts: New York City, New York. US Census Bureau website. Accessed May 15, 2020. https://www.census.gov/quickfacts/newyorkcitynewyork

Prevalence, Characteristics, and Costs of Urgent Care Center Membership Programs

Demand for urgent care centers (UCCs) has increased significantly over the last decade as patients seek timely and affordable health care.[1] Some UCCs have begun membership programs that offer access to discounted visits for recurrent fees. We examined the prevalence, characteristics, and costs of UCCs offering membership programs in the United States.

Supplemental content

Methods | This study received institutional review board exemption from the Yale School of Medicine. Five UCCs (defined as walk-in clinics in an ambulatory medical facility outside of a hospital-based or freestanding emergency department) from each of the 50 states were randomly selected from the Solv Health Directory, a community-sourced listing of approximately 11 000 UCCs. Although Solv Health is a commercial directory, UCCs are not required to pay to be listed in the directory. Affiliation with a hospital or health system, association with a large national urgent care network (eg, Concentra and NextCare), and accreditation status were obtained from the directory and the UCCs' websites. Median household income in each UCC's zip code was obtained from the 2017 American Community Survey.[2]

Trained investigators posing as uninsured patients used a standardized script (eAppendix in the Supplement) to ask UCC receptionists about individual membership programs. Calls were made in August 2019, during which information about program eligibility and cost of an urgent care visit was collected.

Statistical analysis was performed using JMP Pro version 13. Characteristics between membership and nonmembership UCCs were compared using χ^2 tests and unpaired *t* tests. A 2-sided $P < .05$ was considered statistically significant.

Results | Of 250 UCCs contacted, 15 (6%) offered membership programs. Membership programs were offered in 10 states, with 2 or 3 UCCs of the 5 contacted in 3 states offering such programs. **Table 1** compares characteristics and differences between membership and nonmembership UCCs. Membership UCCs were significantly less likely to be affiliated with a hospital or health system compared with nonmembership UCCs and significantly more likely to belong to large nationwide networks. No significant differences in Joint Commission accreditation, Urgent Care Association accreditation, or income quartile of the UCC's community were observed.

Respondents from all 15 membership programs reported that any patient, regardless of insurance status, could enroll. Membership fees ranged from $50 per year to $800 per year (mean, $373 [SD, $225]), discounted visit fees for members from $0 to $125 per year (mean, $47 [SD, $38]), and full-price visit fees for nonmembers from $90 to $275 per year (mean, $149 [SD, $43]). Visit fees for members were statistically significantly less for members vs nonmembers (difference, $102; 95% CI, $72-$132; $P < .001$) (**Table 2**).

Discussion | A small number of UCCs in 10 states offered membership programs. Similar programs have been observed in other practice settings, such as the direct primary care model, in which a primary care practice charges periodic and per-visit fees for its services.[3] Compared with nonmembership UCCs, those offering memberships were more often unaffiliated with hospitals and associated with large national urgent care networks.

These membership programs may offer convenience and improve access to care for uninsured and underinsured patients. However, there are serious disadvantages, including limited continuity of care and additional fees for imaging and laboratory services. These programs are unlikely to save most people money. Membership fees do not contribute to insurance deductibles and cannot be paid using health savings accounts or flexible spending accounts, possibly increasing patient out-of-pocket costs. Given an estimated mean cost savings

Table 1. Characteristics of Membership and Nonmembership UCCs

Characteristics of UCC	UCCs, No. (%)			
	Overall (N = 250)[a]	Membership (n = 15)	Nonmembership (n = 235)	*P* value[b]
Affiliation with hospital or health network	117 (47)	2 (13)	115 (49)	.01
Association with large national urgent care network	30 (12)	7 (47)	23 (10)	<.001
Joint Commission accredited	24 (10)	0	24 (10)	.37
Urgent Care Association accredited	21 (8)	1 (7)	20 (9)	.80
Income quartile of UCC zip code relative to the state				.90
Lowest	30 (12)	1 (7)	29 (12)	
Second	47 (19)	3 (20)	44 (19)	
Third	72 (29)	4 (27)	68 (29)	
Highest	101 (40)	7 (47)	94 (40)	

Abbreviation: UCC, urgent care center.

[a] Indicates all UCCs included in this study.

[b] *P* values reflect the comparison between membership UCCs and nonmembership UCCs using the Fisher exact test (for comparisons with frequency <5) and the χ^2 test.