

US Deaths

A Casualty Actuarial View of US Mortality Statistics

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NOVEMBER 10, 2021



ON A POSITIVE NOTE...



**NO ONE HAS DIED FROM
OLD AGE SINCE MARCH**

ifunny.co

Introduction

- “Excess” Deaths = Actual minus Expected
- Actual Deaths
 - Center for Disease Control (CDC) – US
 - Human Mortality Database (HMD) – 35+ countries
- Expected Deaths
 - exposure (loosely, number of people alive)
 - expected mortality rate (function of age, gender, and possibly other factors)
- “Extra” Deaths
 - Incremental increase/decrease
- COVID Deaths
 - Based on subjective coding

Death Counts (example)

▪ Actual Deaths (Year 0)	198	Data
▪ Expected Deaths (Year 1)	200	Trended
▪ Actual Deaths (Year 1)	210	Estimated
▪ Excess Deaths (Year 1)	10	Actual - Expected
▪ Excess Ratio	5%	Excess / Expected
▪ Extra Deaths	12	Actual (t=1) - Actual (t=0)
▪ COVID Deaths	9	Estimated Separately
▪ COVID-to-Excess	90%	COVID / Excess

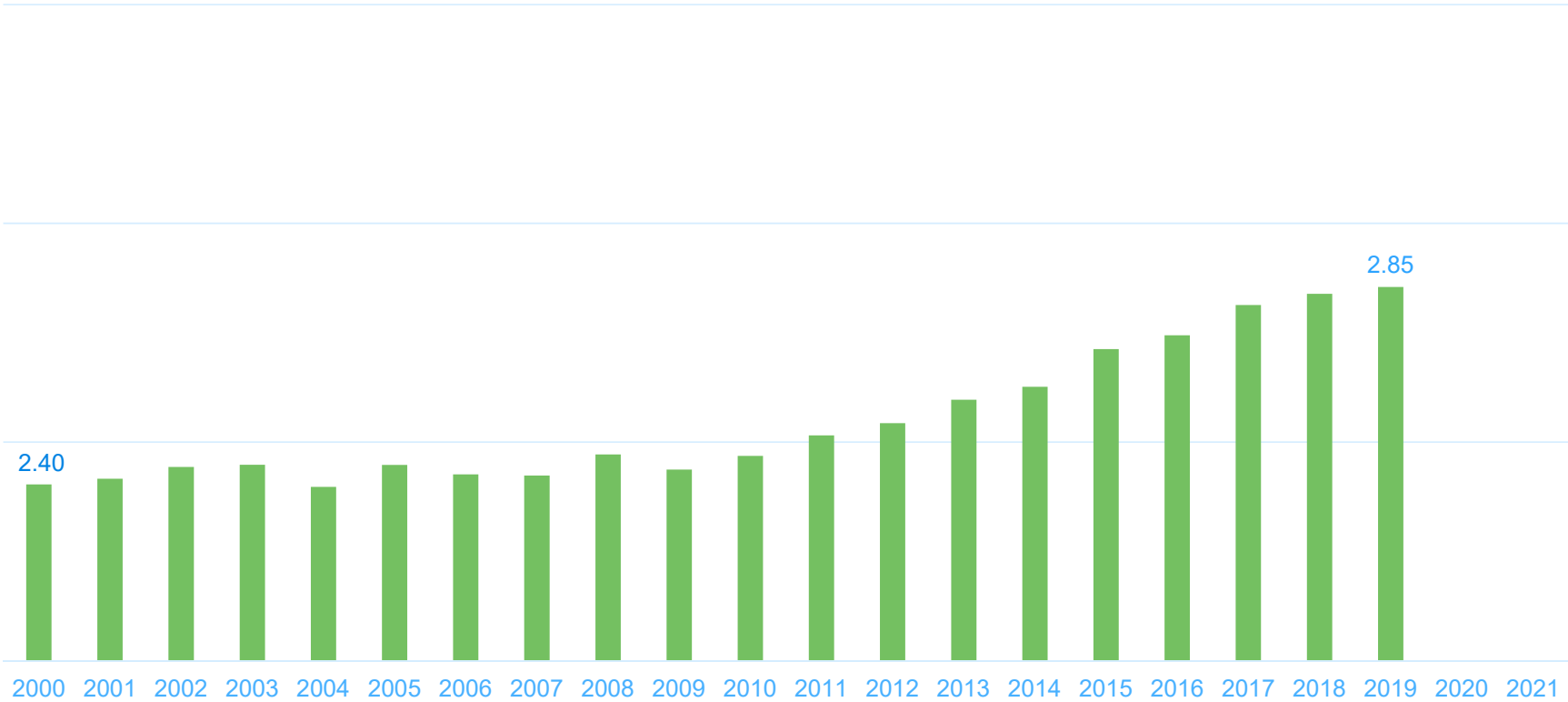
Actual

US Data

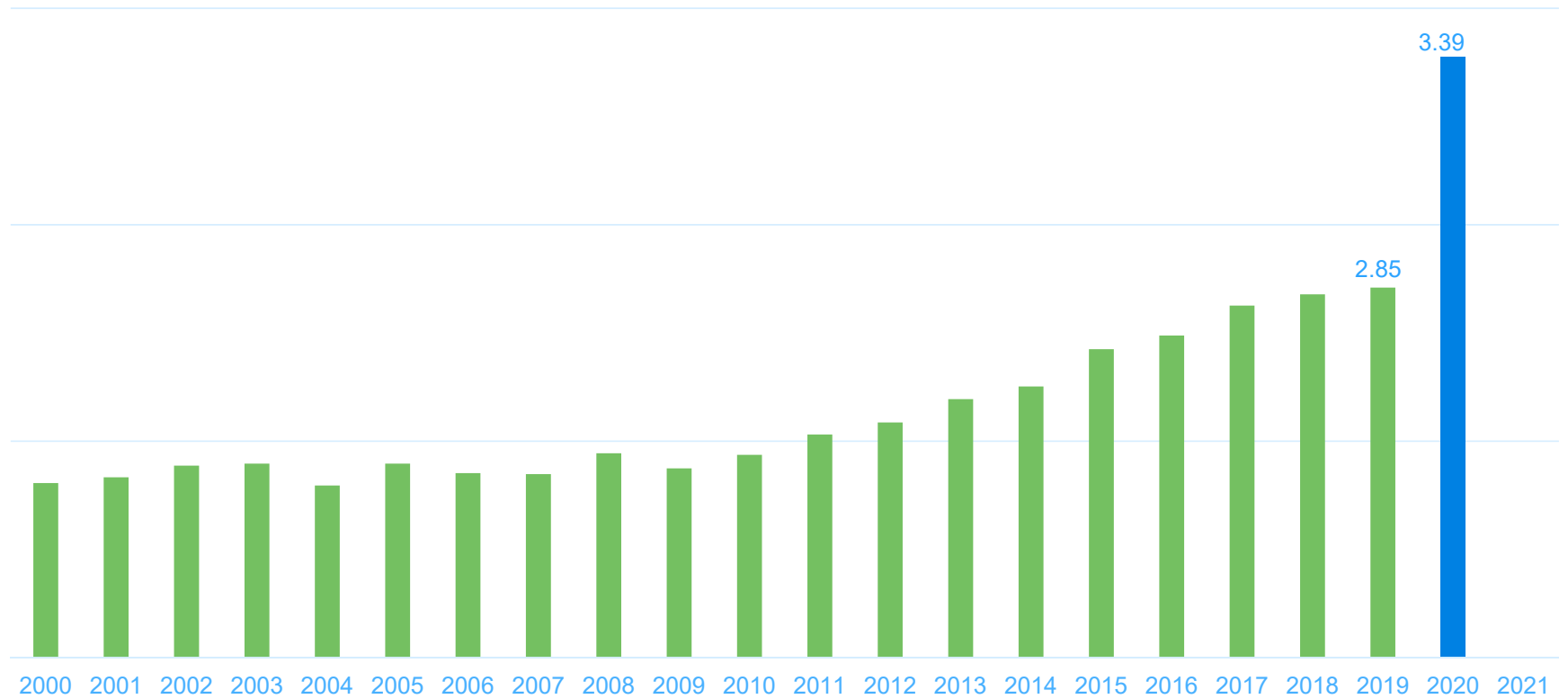
- Center for Disease Control
 - 1900-1998: Annual Deaths (national only)
 - 1999-2019: Annual Deaths by State
 - 2020-2021: Weekly and Monthly Deaths by State
 - Updated daily (work days); captured Friday “snap shots” in 2021
 - <https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm>

Data as of	Start Date	End Date	Group	Year	State	COVID-19	Total Deaths
10/22/2021	12/29/2019	1/4/2020	By Week	2019/2020	United States	0	60,156
10/22/2021	1/5/2020	1/11/2020	By Week	2020	United States	1	60,723
10/22/2021	1/12/2020	1/18/2020	By Week	2020	United States	2	59,334
10/22/2021	1/19/2020	1/25/2020	By Week	2020	United States	2	59,145
10/22/2021	1/26/2020	2/1/2020	By Week	2020	United States	0	58,806
:	:	:	:	:	:	:	:
10/22/2021	9/26/2021	10/2/2021	By Week	2021	Wyoming	46	124
10/22/2021	10/3/2021	10/9/2021	By Week	2021	Wyoming	31	94
10/22/2021	10/10/2021	10/16/2021	By Week	2021	Wyoming	20	49

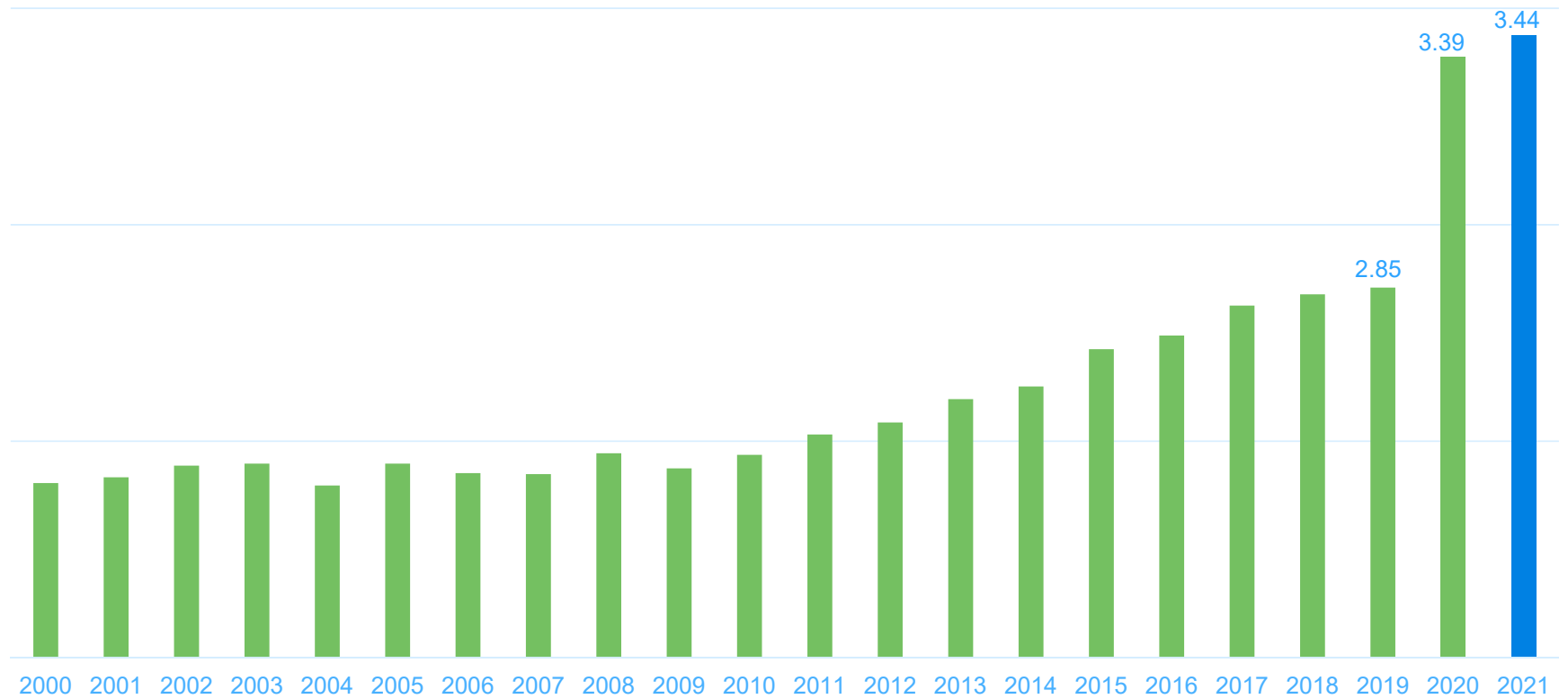
US Deaths by Year (2000-2019)



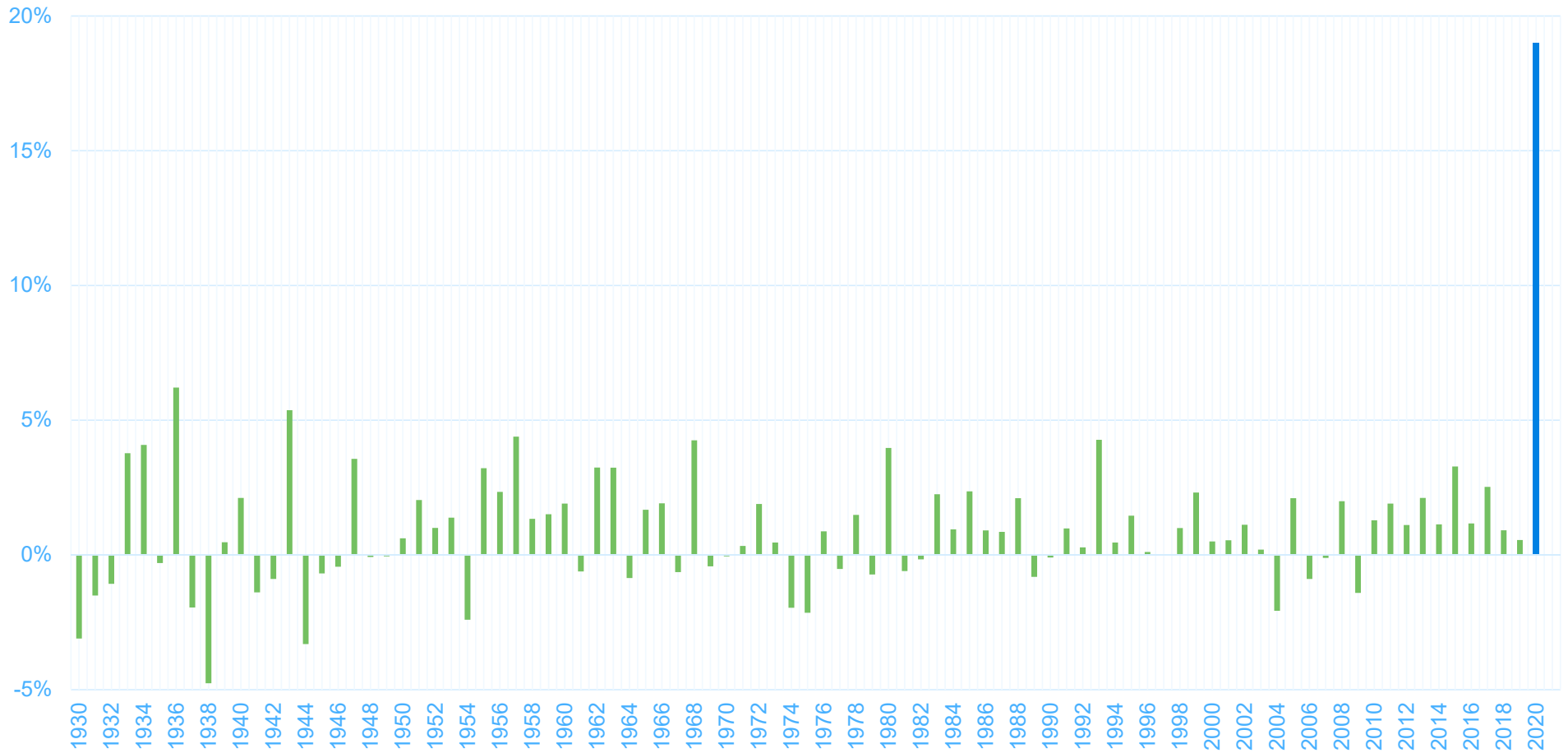
US Deaths by Year (2000-2020)



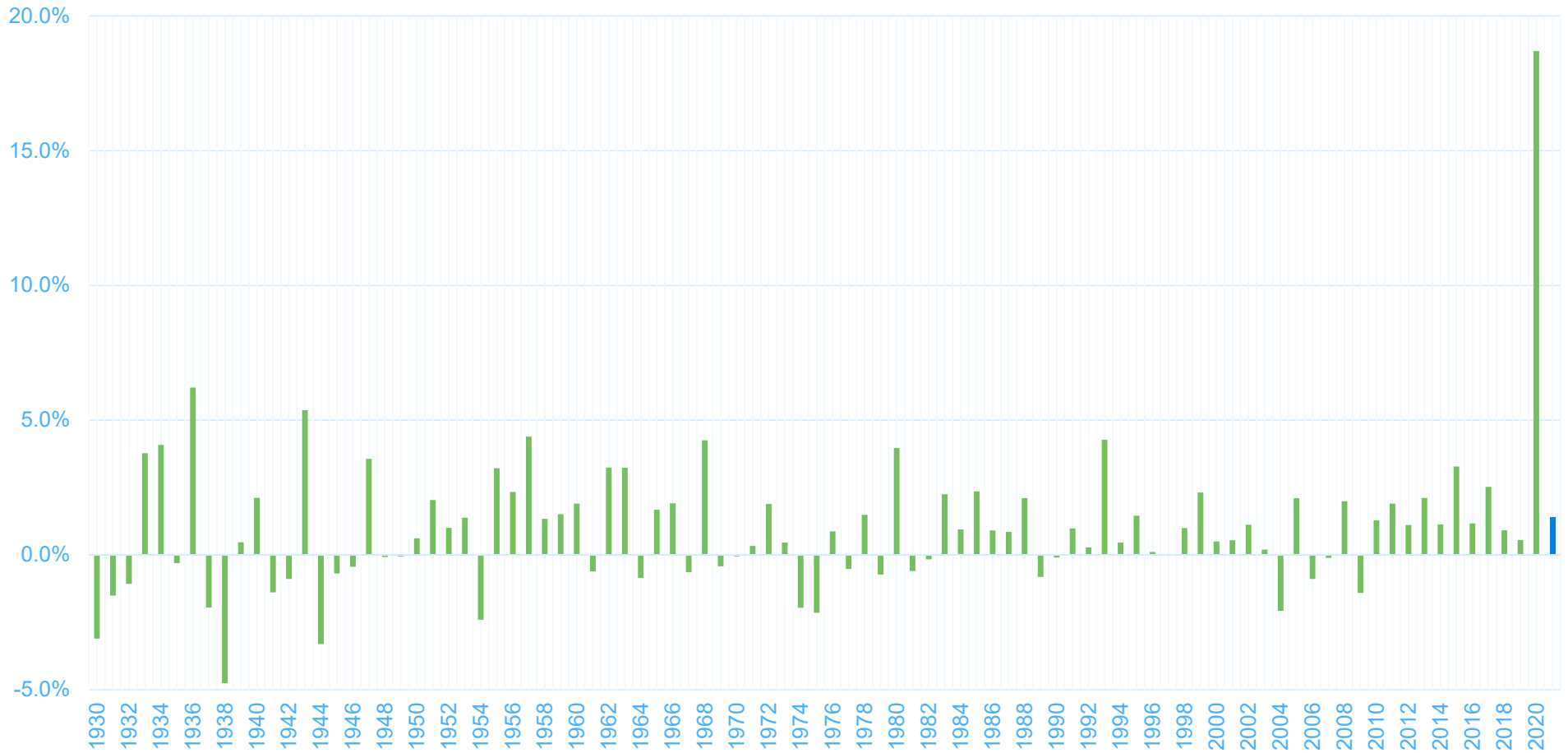
US Deaths by Year (2000-2021)



Percent Change in US Deaths by Year (1930-2020)



Percent Change in US Deaths by Year (1930-2021)

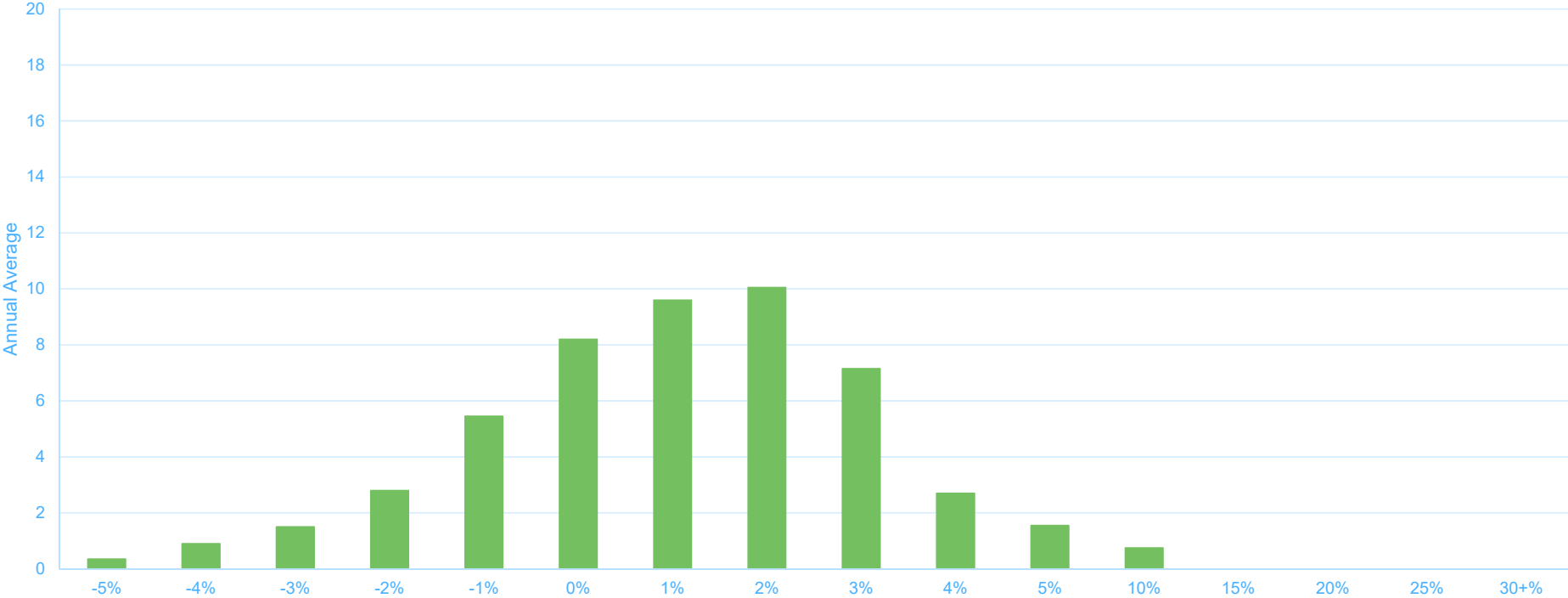


Change in Annual Deaths

Decade	US Average	US Range	Highest State
1930-39	0%	-5% to +6%	
1940-49	0%	-3% to +5%	
1950-59	1%	-2% to +4%	
1960-69	2%	-1% to +4%	
1970-79	0%	-2% to +2%	
1980-89	1%	-1% to +4%	
1990-99	1%	-1% to +4%	
2000-09	1%	-2% to +2%	+8% (AK, 1999)
2010-19	1%	-1% to +3%	+10% (LA, 2005)
2020	19%		+51% DC; +32% ND

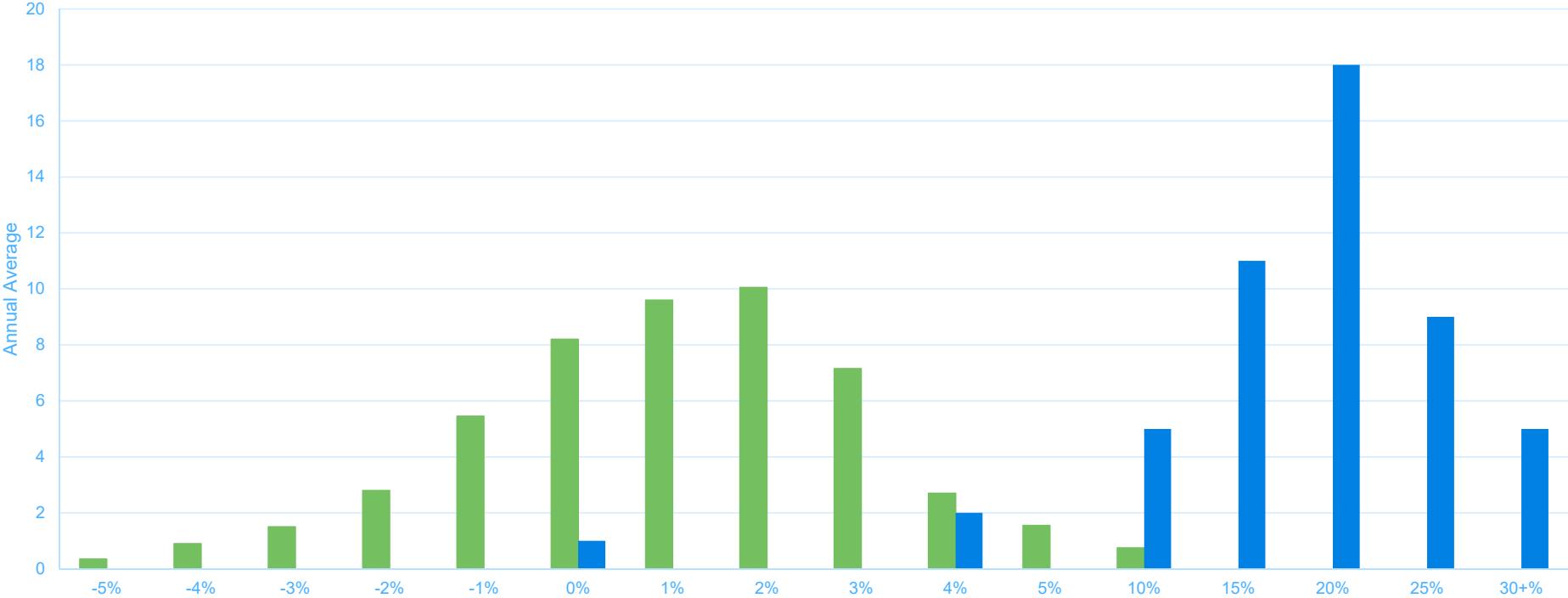
Annual Change in Deaths by State (1999-2019)

Spread of Percentage of Deaths (Annual Average Comparison)



Annual Change in Deaths by State (1999-2020)

Spread of Percentage of Deaths (Annual Average Comparison)

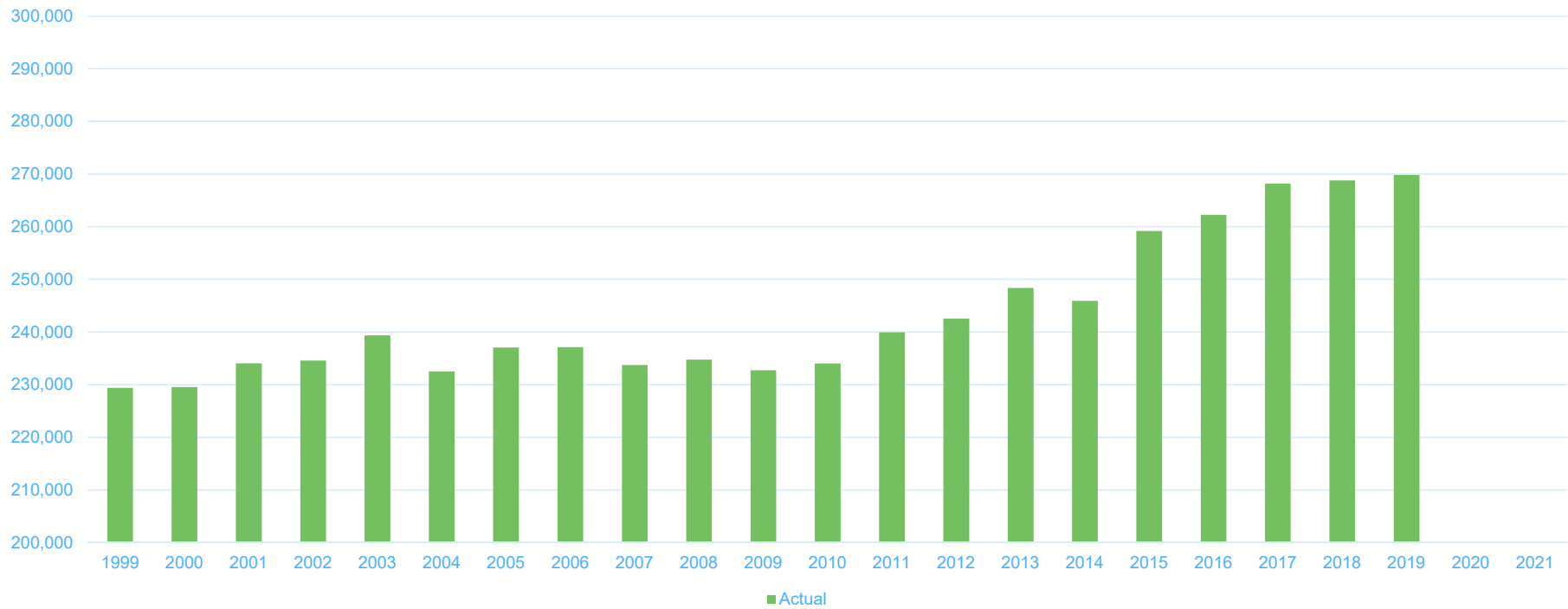


Expected

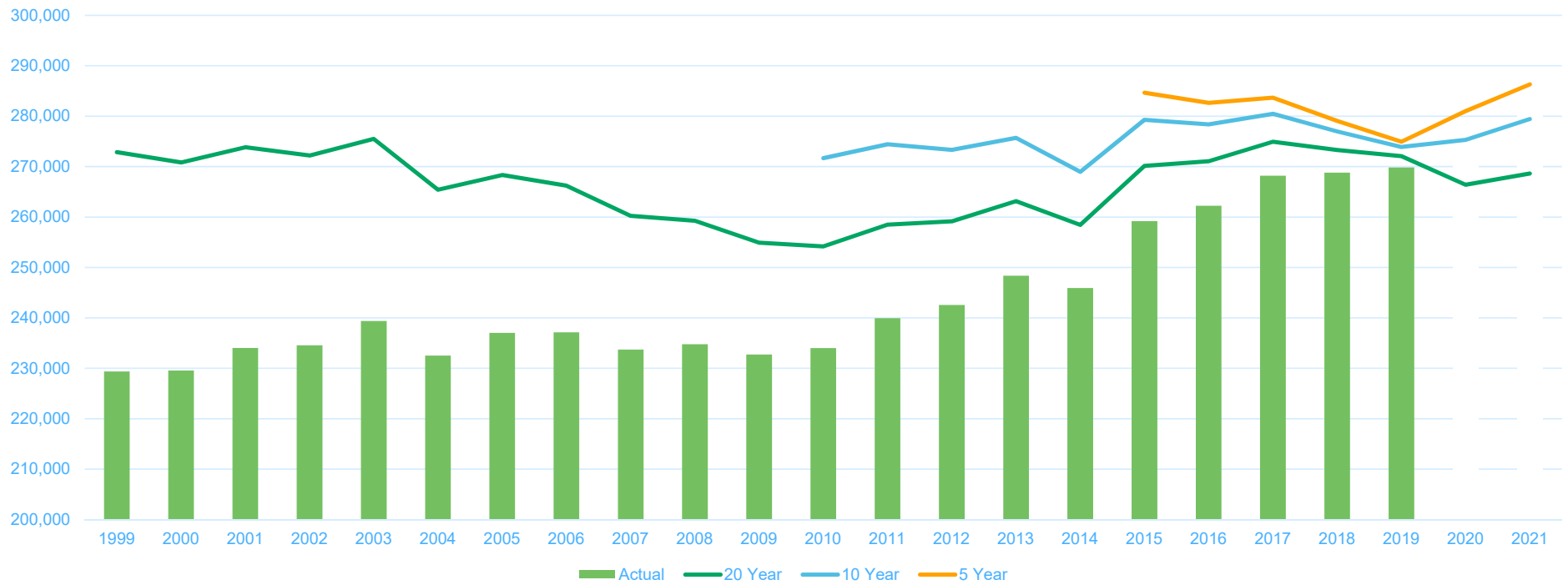
Expected Deaths By State - Annual

- Standardized Projections By State for Consistency
 - Baseline: 1999 through 2019
 - 5-year, 10-year, 20-year trends
- 2021 is projected independently of 2020
- Future Enhancements ?
 - Population
 - Other demographics

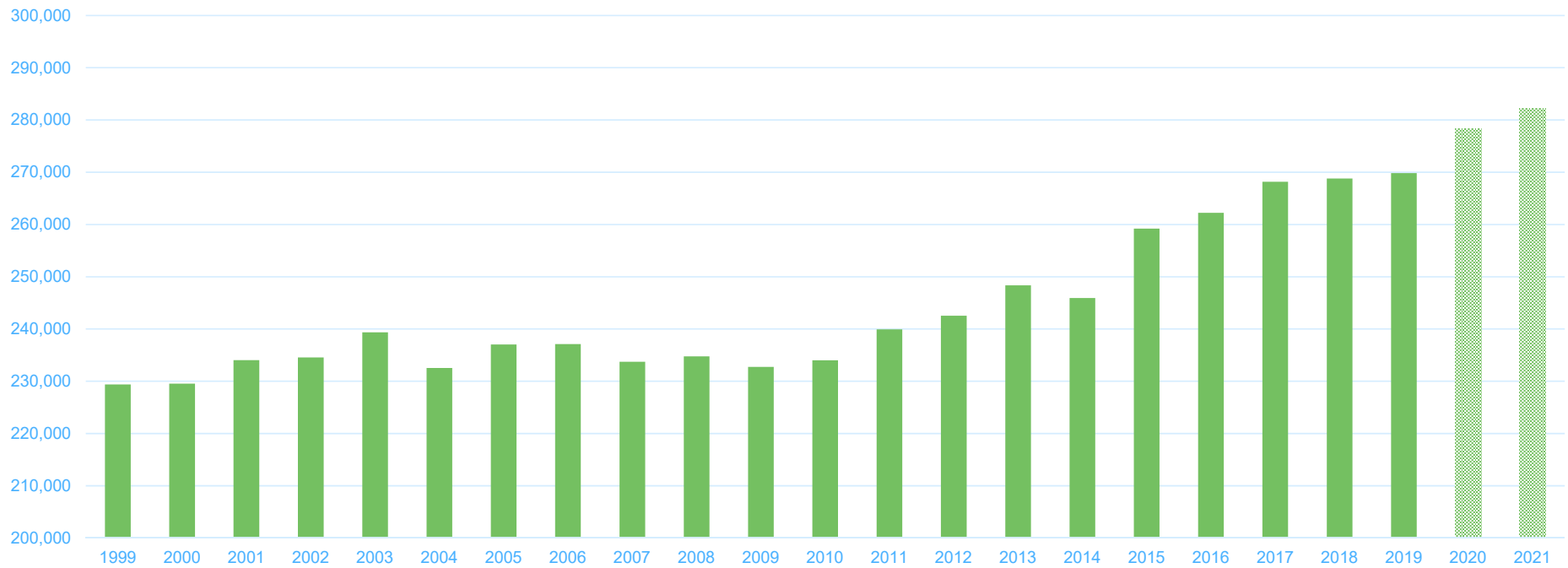
Expected Deaths Example (California)



Expected Deaths Example (California)

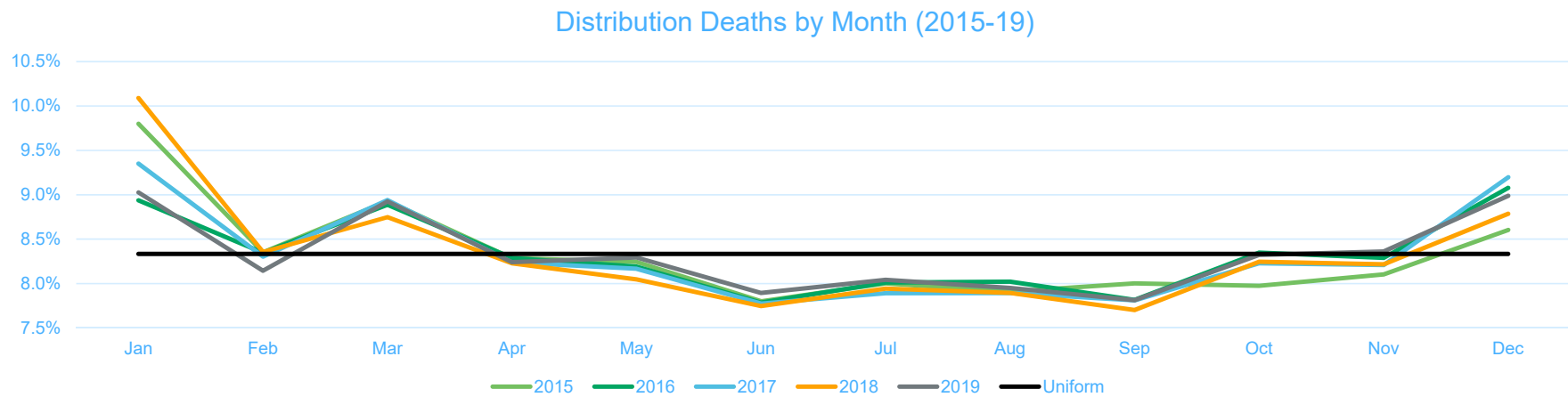


Expected Deaths Example (California)



Expected Deaths By State - Monthly

- Clear seasonality on a national basis
 - Assumed same pattern for every state
- Differences largely disappear on a quarterly basis
 - Through 3/31: **26.6%** vs 25.0%; Through 6/30: **50.9%** vs 50.0%; Through 9/30: **74.6%** vs 75.0%.

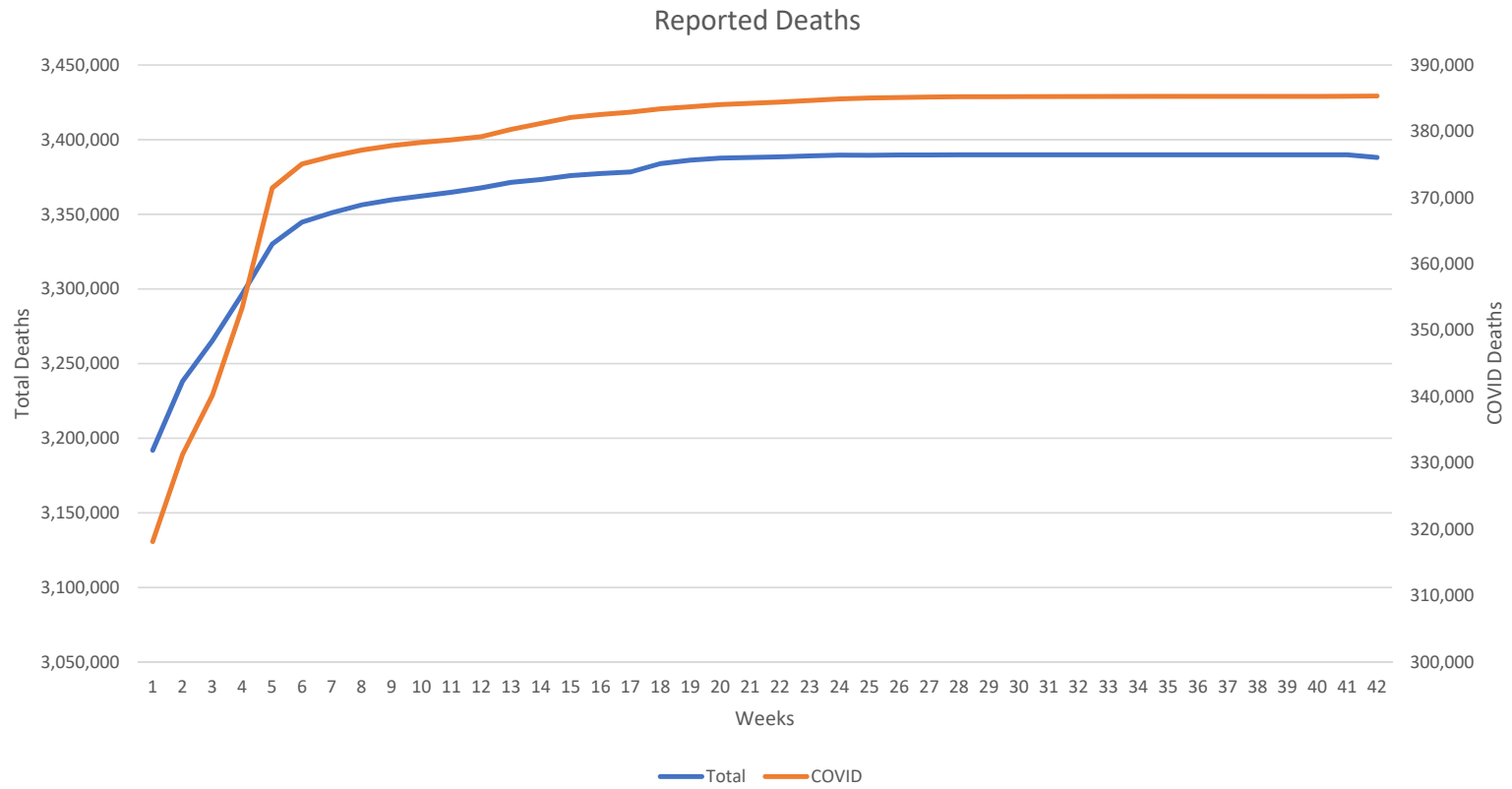


Estimated

Methodology

- Used Milliman Arius
 - Exposure Periods: Weeks
 - Valuations: Fridays in 2021 (90 x 90 “triangles”)
 - Data Elements: Total Deaths (reported claims); COVID-19 Deaths (CWIP claims)
 - 53 “states” – DC, NYC, PR
 - “Under 10” issue
- Use the CDC data to estimate Deaths by Week (“earned”)
 - Like a reserve study, with complicated development factors
- Estimate Deaths for Future Periods
 - Like a funding study, with really complicated future exposures
 - Like unearned premium reserve (e.g., auto warranty coverages)

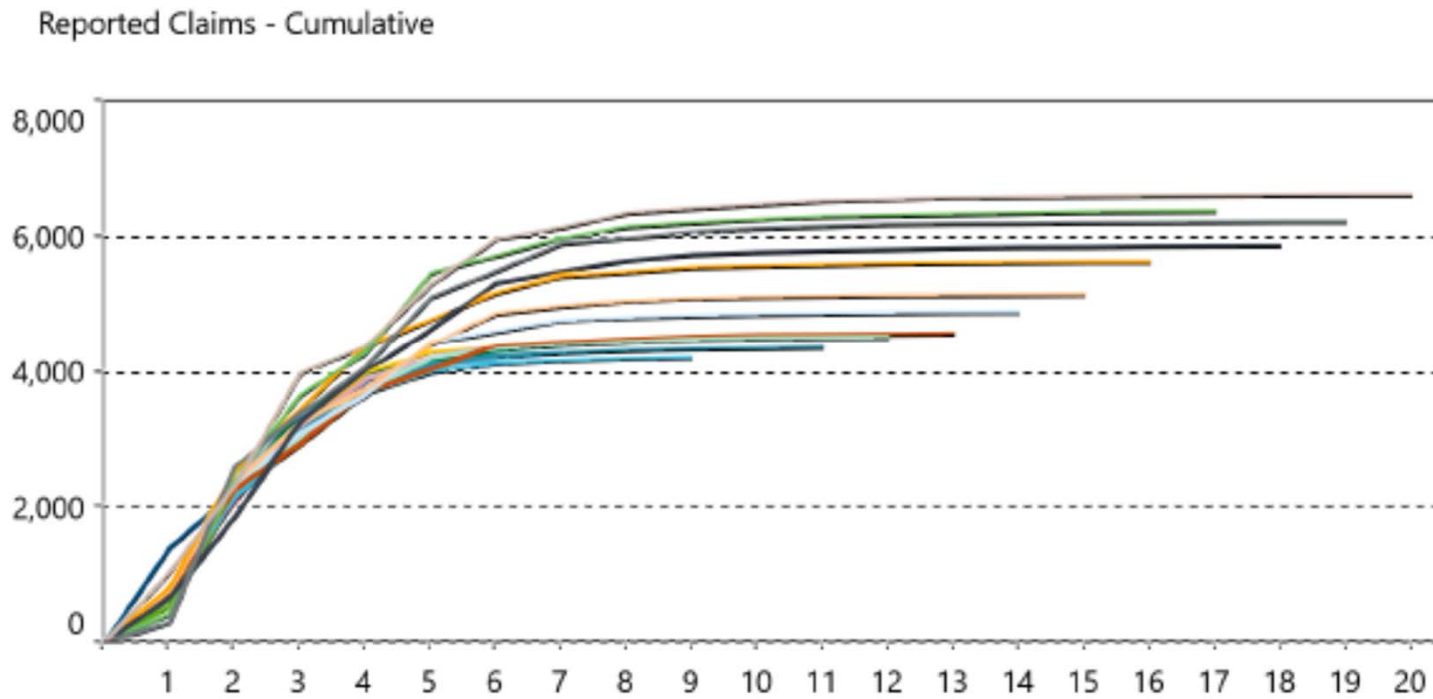
2020 Deaths reported in 2021



Development Example

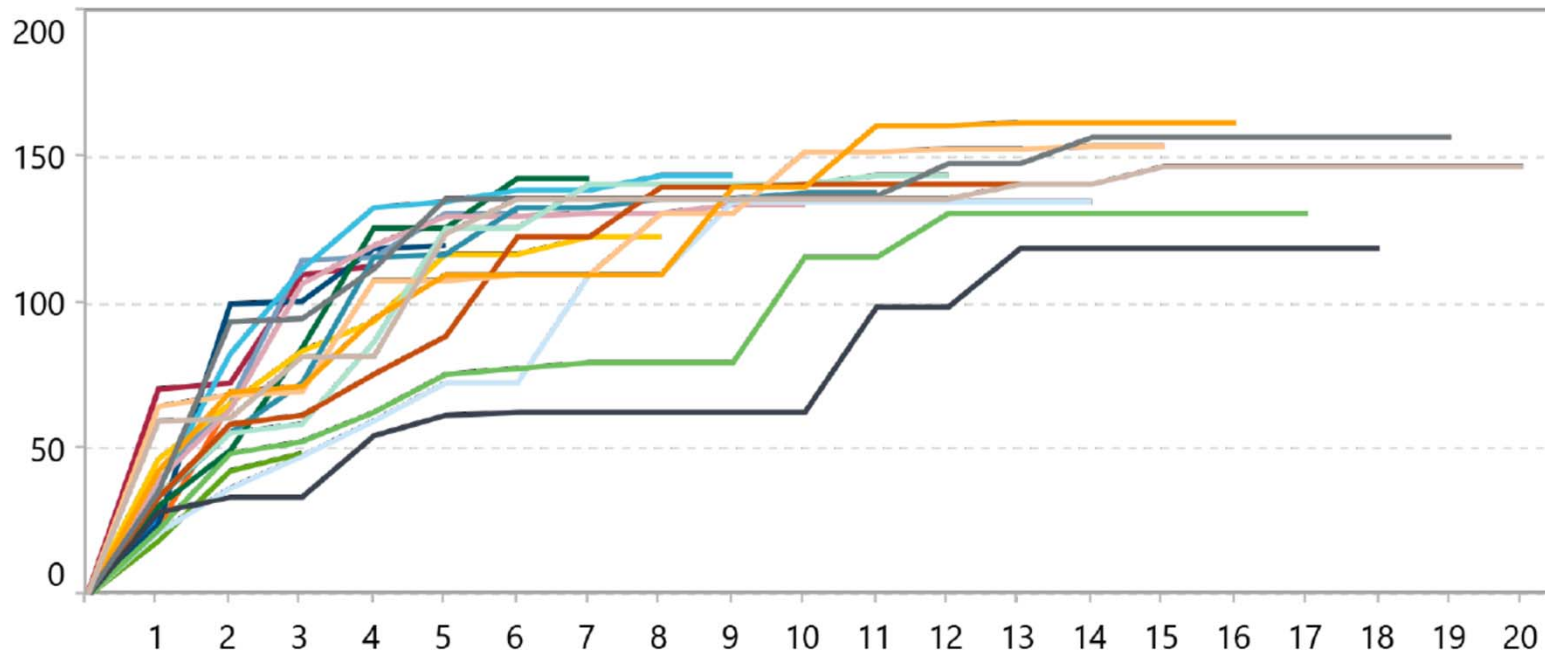
Week Ending	Age (Weeks)	Reported	DF	DFU	Ultimate
8/21/2021	9	5,975	1.003	1.011	6,283
8/28/2021	8	6,214	1.004	1.014	6,331
9/4/2021	7	6,244	1.009	1.018	6,405
9/11/2021	6	6,401	1.010	1.027	6,575
9/18/2021	5	5,969	1.017	1.044	6,234
9/25/2021	4	5,724	1.042	1.088	6,230
10/2/2021	3	4,745	1.112	1.210	5,744
10/9/2021	2	3,451	1.334	1.615	5,574
10/16/2021	1	1,548	2.166	3.499	5,416

Texas Reported Claims



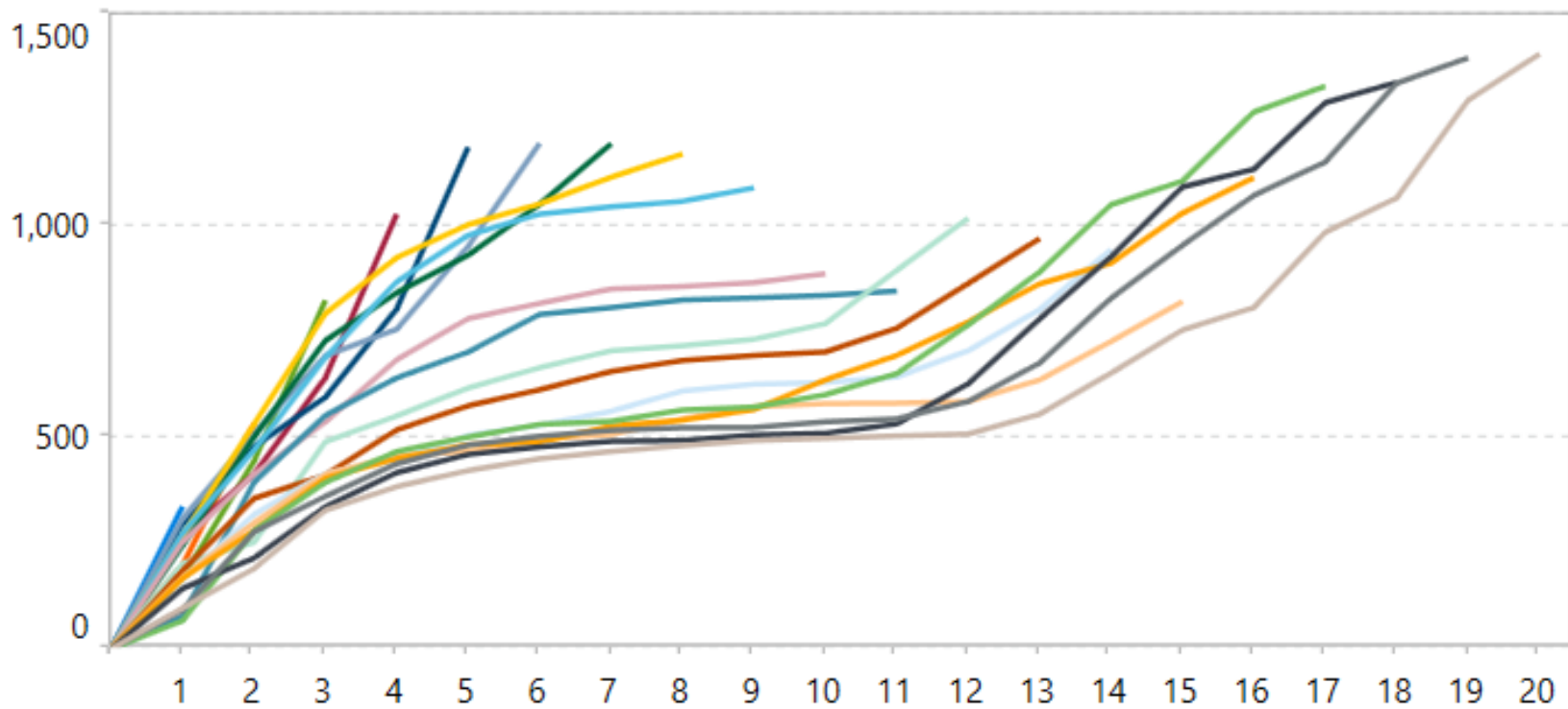
North Dakota Reported Claims

Reported Claims - Cumulative



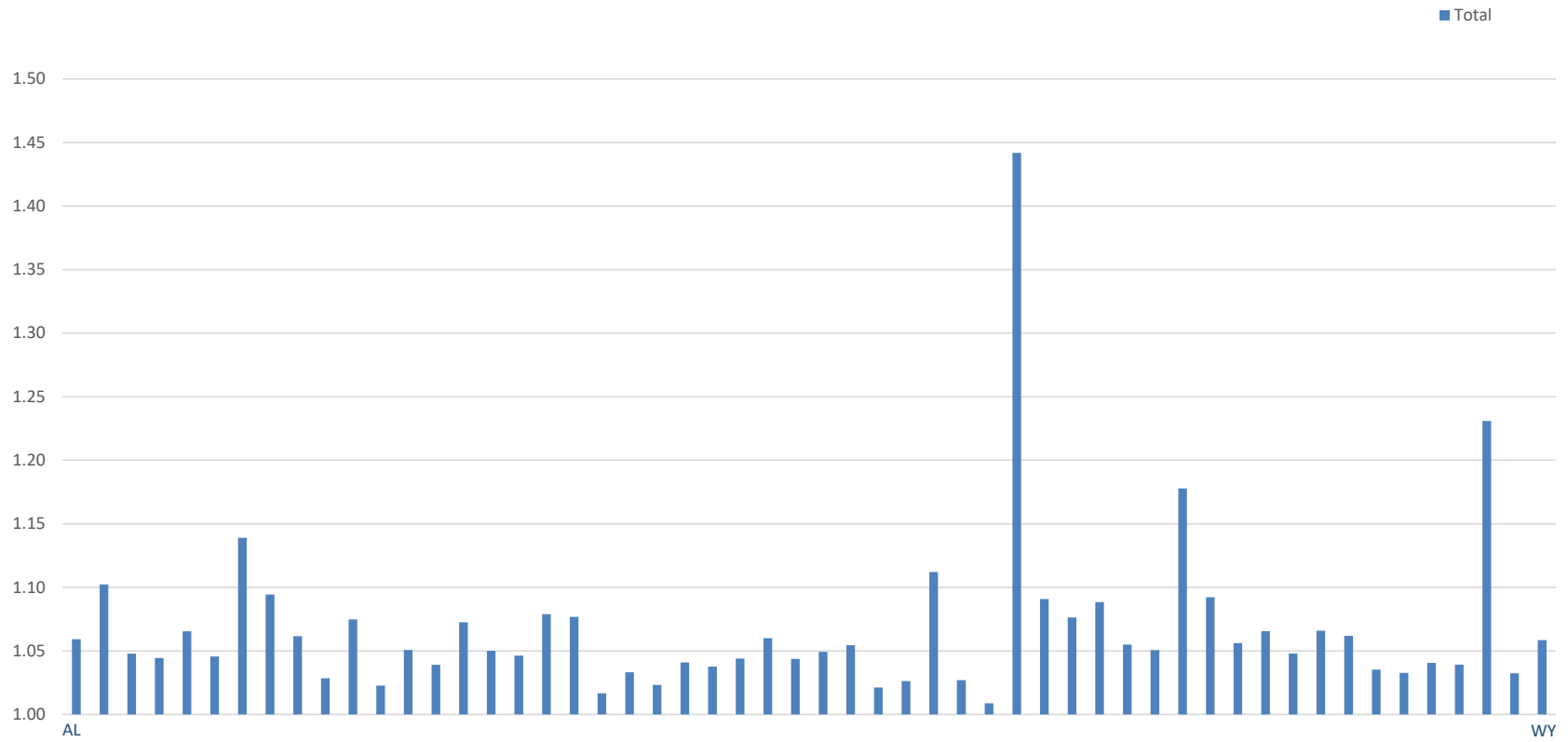
North Carolina Reported Claims

Reported Claims - Cumulative



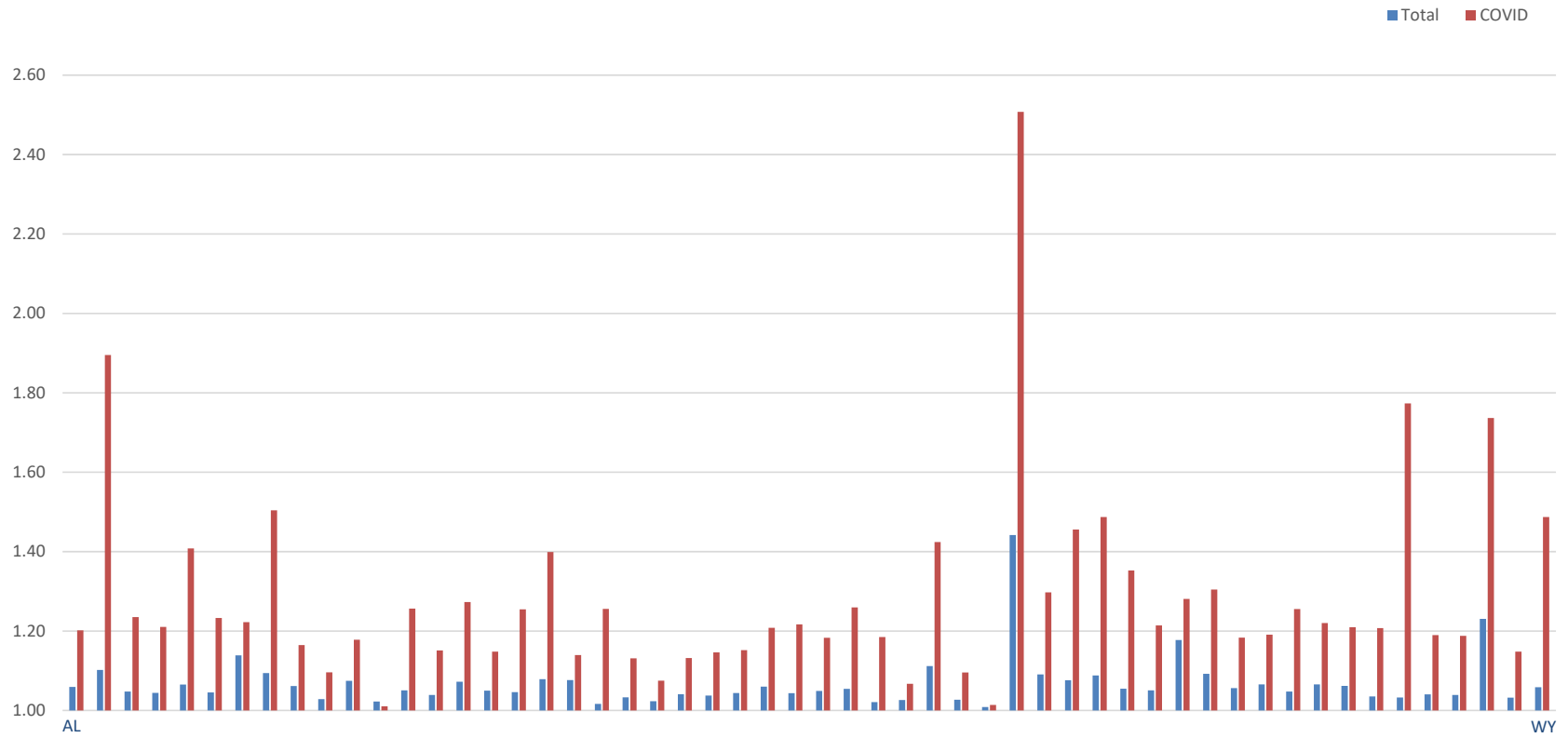
Development Factors by State

Development Factors (beyond 12/31)



Development Factors by State

Development Factors (beyond 12/31)



Methodology (continued)

- Weekly development factors rolled up to Monthly
- Small / unusual states weighted with national DFs
- B-F Method for most recent periods
 - Annual expected based on 1999 through 2019
 - “Mechanical” parameters to reduce bias
 - Monthly expected by state uses national monthly state distribution

2021 California Total Deaths

Month	Reported	DFU	Project	Expected	Ratio	Select	Ultimate	DBNR
Jan	48,130	1.000	48,146	26,641	1.81		48,146	16
Feb	30,023	1.000	30,038	23,421	1.28		30,038	15
Mar	26,748	1.001	26,773	25,075	1.07		26,773	25
Apr	23,218	1.002	23,254	23,295	1.00		23,254	36
May	23,442	1.002	23,499	23,107	1.02		23,499	57
Jun	22,624	1.004	22,710	22,010	1.03		22,710	86
Jul	23,594	1.006	23,728	22,511	1.05		23,728	134
Aug	26,765	1.011	27,064	22,385	1.21		27,064	299
Sep	25,146	1.069	26,875	22,090	1.22	1.22	26,913	1,767
Oct				23,205		1.24	28,850	28,850
Nov				23,239		1.24	28,892	28,892
Dec				25,200		1.24	31,331	31,331

2021 West Virginia Total Deaths

Month	Reported	DFU	Project	Expected	Ratio	Select	Ultimate	DBNR
Jan	2,915	1.000	2,915	2,256	1.29		2,915	0
Feb	2,170	1.001	2,171	1,983	1.09		2,171	1
Mar	2,195	1.001	2,197	2,123	1.03		2,197	2
Apr	2,122	1.002	2,127	1,972	1.08		2,127	5
May	2,071	1.006	2,084	1,956	1.07		2,084	13
Jun	1,950	1.031	2,010	1,864	1.08	1.08	2,014	64
Jul	1,584	1.045	1,655	1,906	0.87	1.10	2,097	513
Aug	379	1.069	405	1,895	0.21	1.10	2,085	1,706
Sep	542	1.140	618	1,870	0.33	1.10	2,057	1,515
Oct				1,965		1.15	2,257	2,257
Nov				1,968		1.15	2,260	2,260
Dec				2,134		1.15	2,451	2,451

BF Ratio

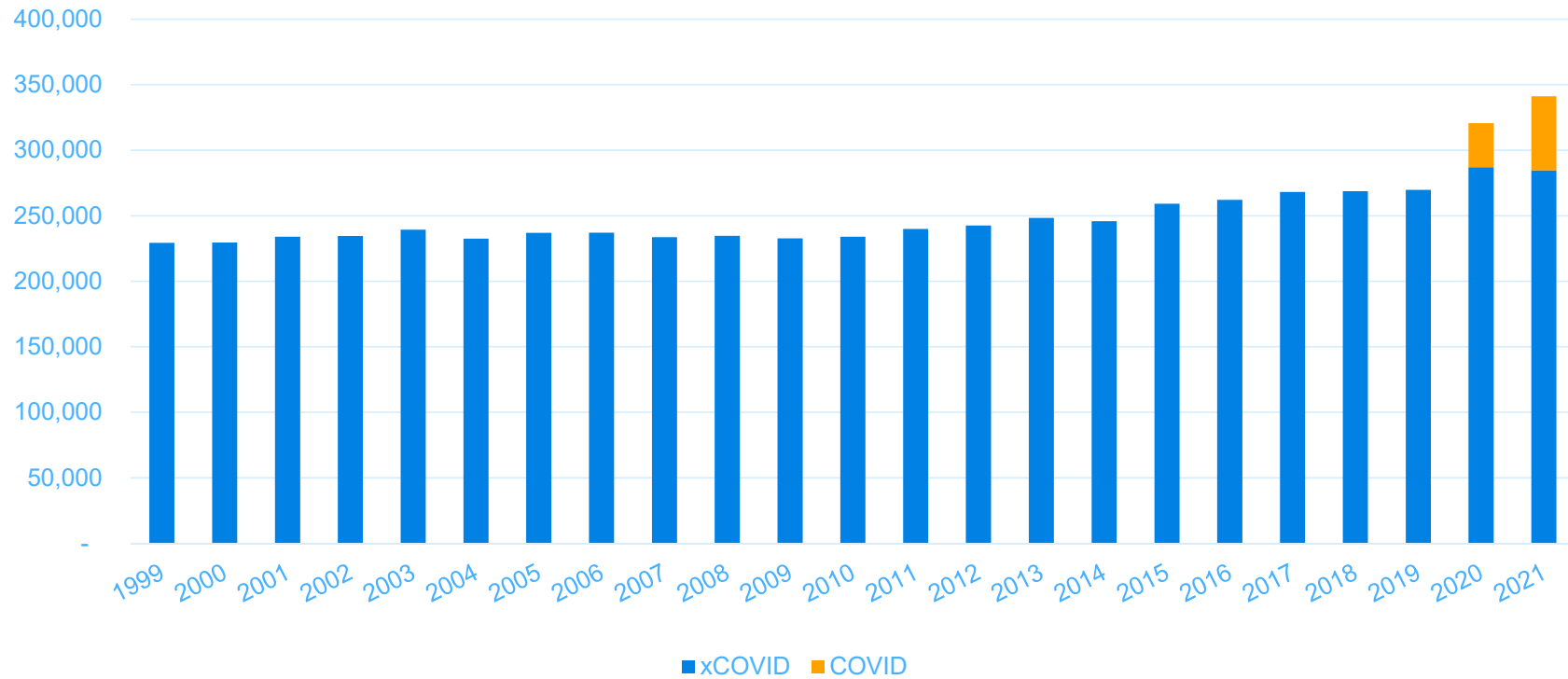
California

<u>From</u>	<u>To</u>	<u>Relativity</u>	<u>COVID%</u>
Jul-20	Jun-21	1.23	17.1%
Jan-21	Jul-21	1.19	16.7%
Oct-20	Dec-20	1.30	18.7%
Average		1.24	17.5%
Select		1.24	17.5%

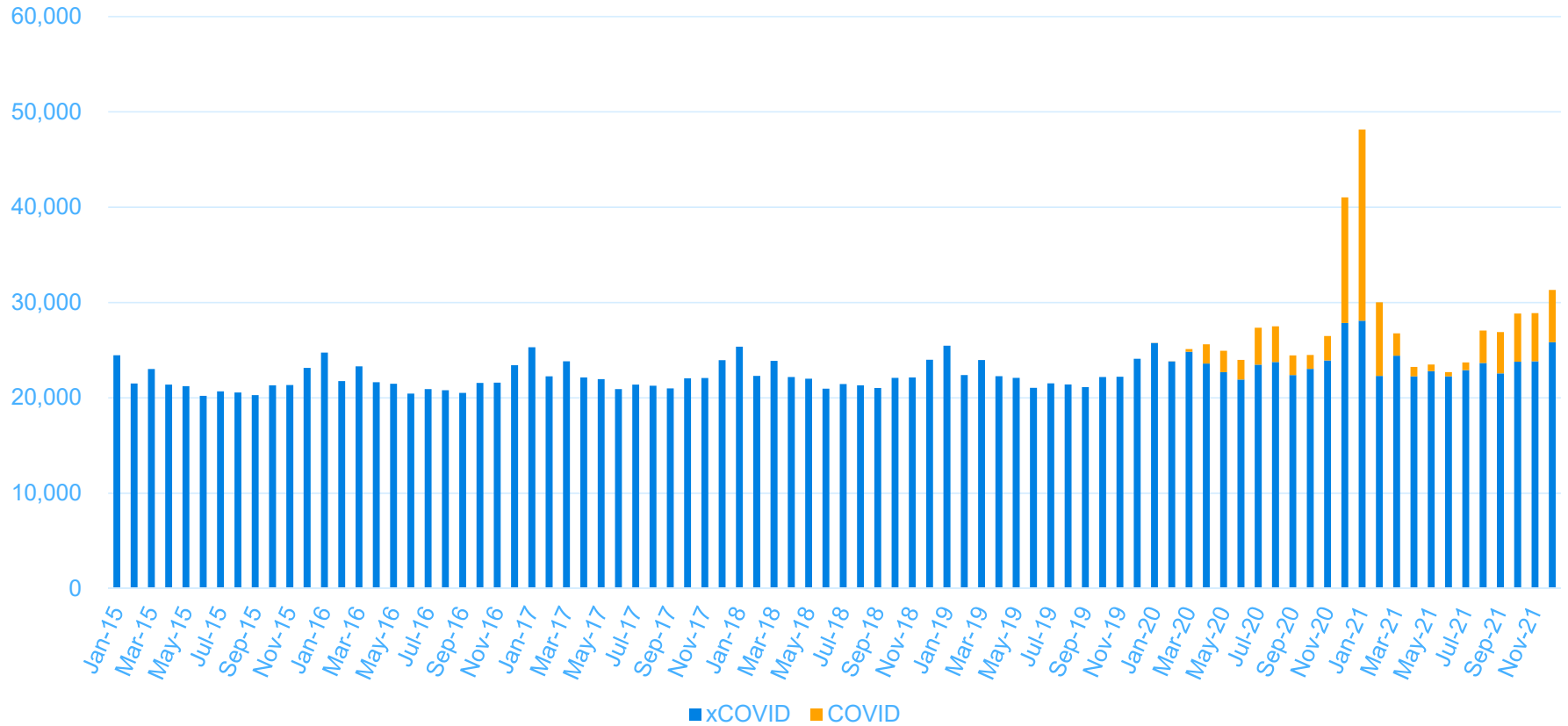
West Virginia

<u>From</u>	<u>To</u>	<u>Relativity</u>	<u>COVID%</u>
Jul-20	Jun-21	1.14	10.7%
Jan-21	Jul-21	1.08	9.8%
Oct-20	Dec-20	1.23	16.2%
Average		1.15	12.3%
Select		1.15	12.3%

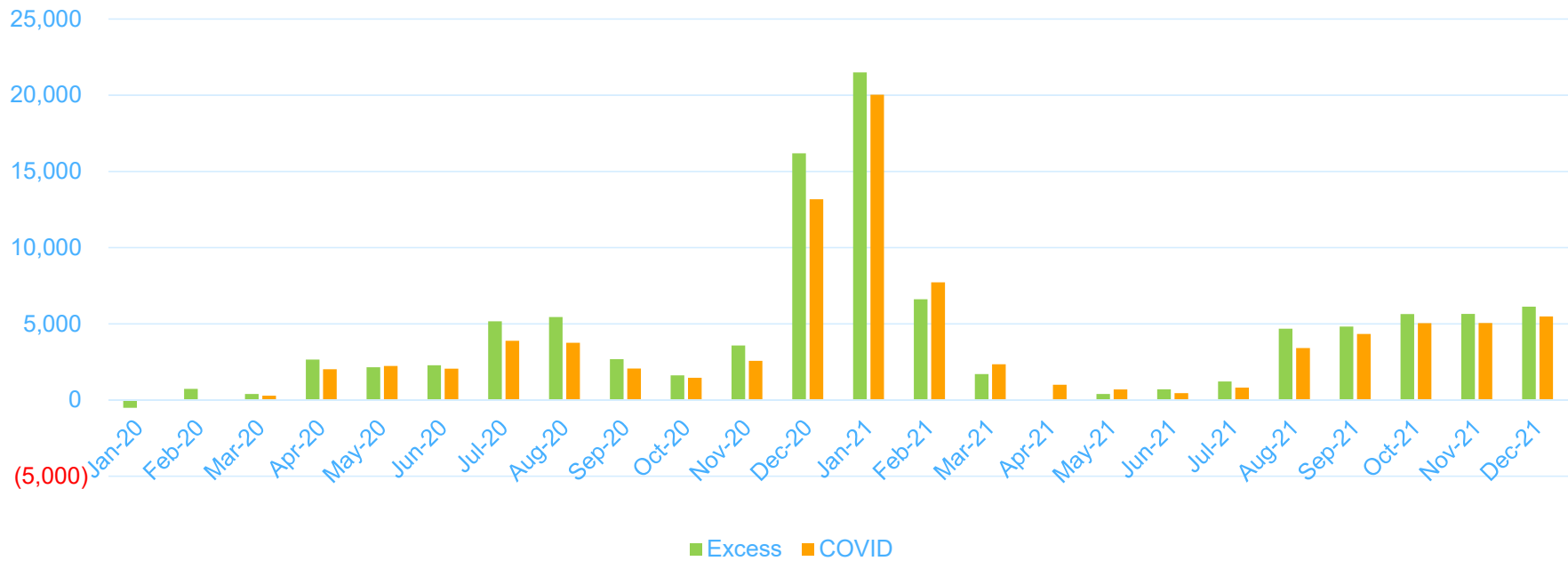
California Charts



California Charts



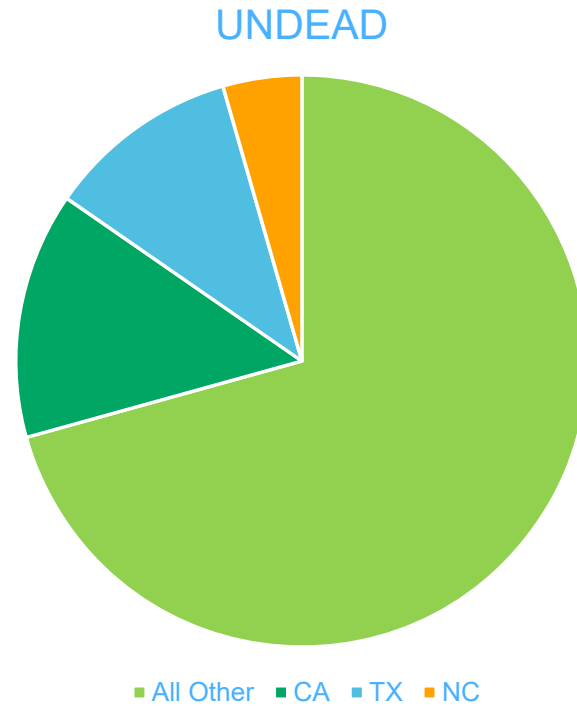
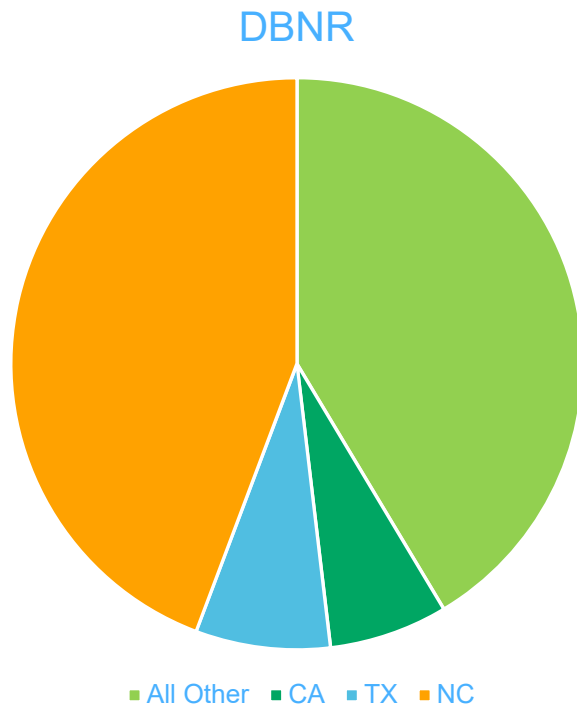
California Charts



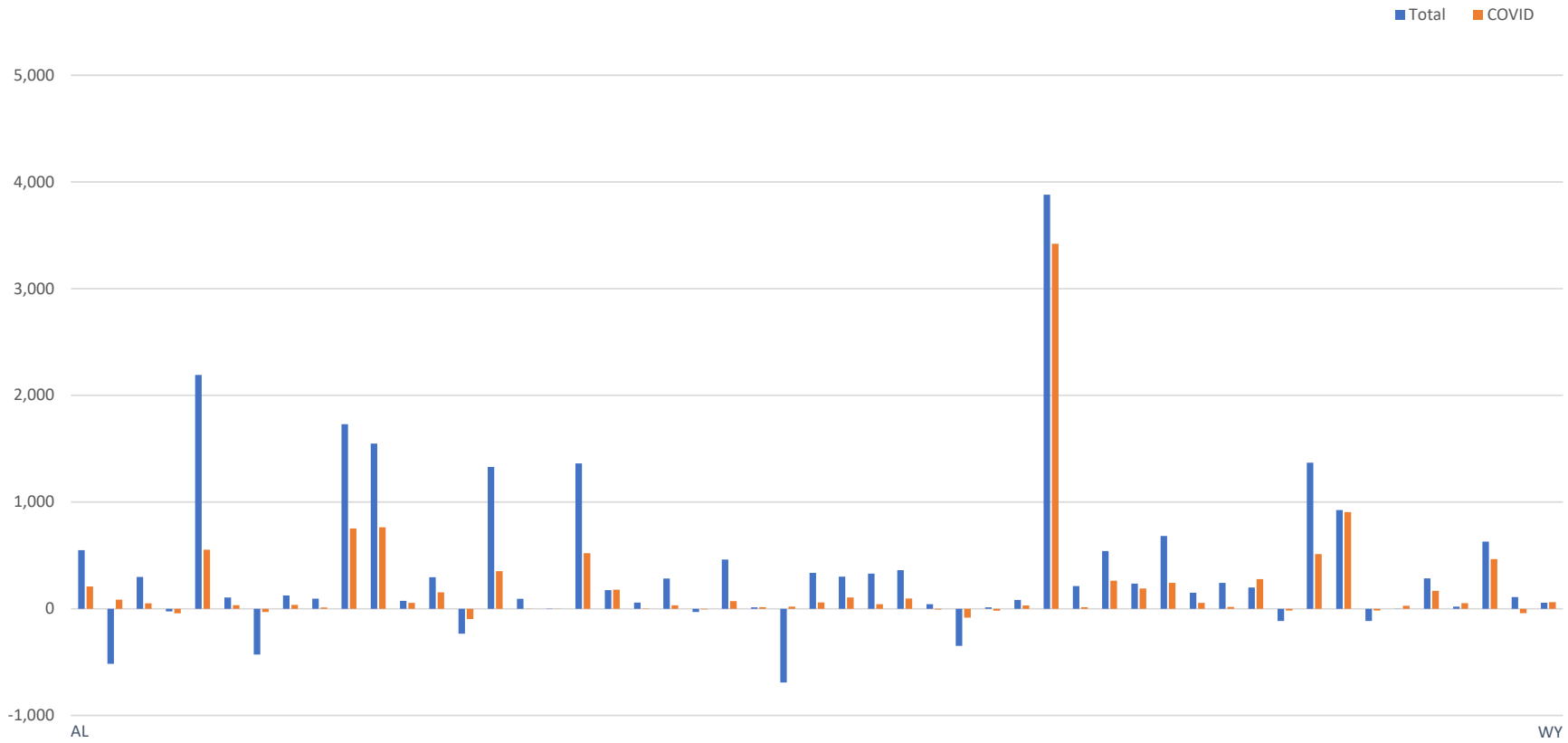
Summary of Results – As of 10/16/2021

	2018	2019	2020	2021
Estimated	2,839,205	2,854,838	3,388,237	3,437,060
Reported	2,839,205	2,854,838	3,388,237	2,498,431
DBNR			0	48,484
Undead			0	890,144
Expected			2,918,676	2,959,991
Actual / Expected			16%	16%
COVID			385,314	472,509
Excess			469,561	477,068
COVID / Excess			82%	99%

Distribution

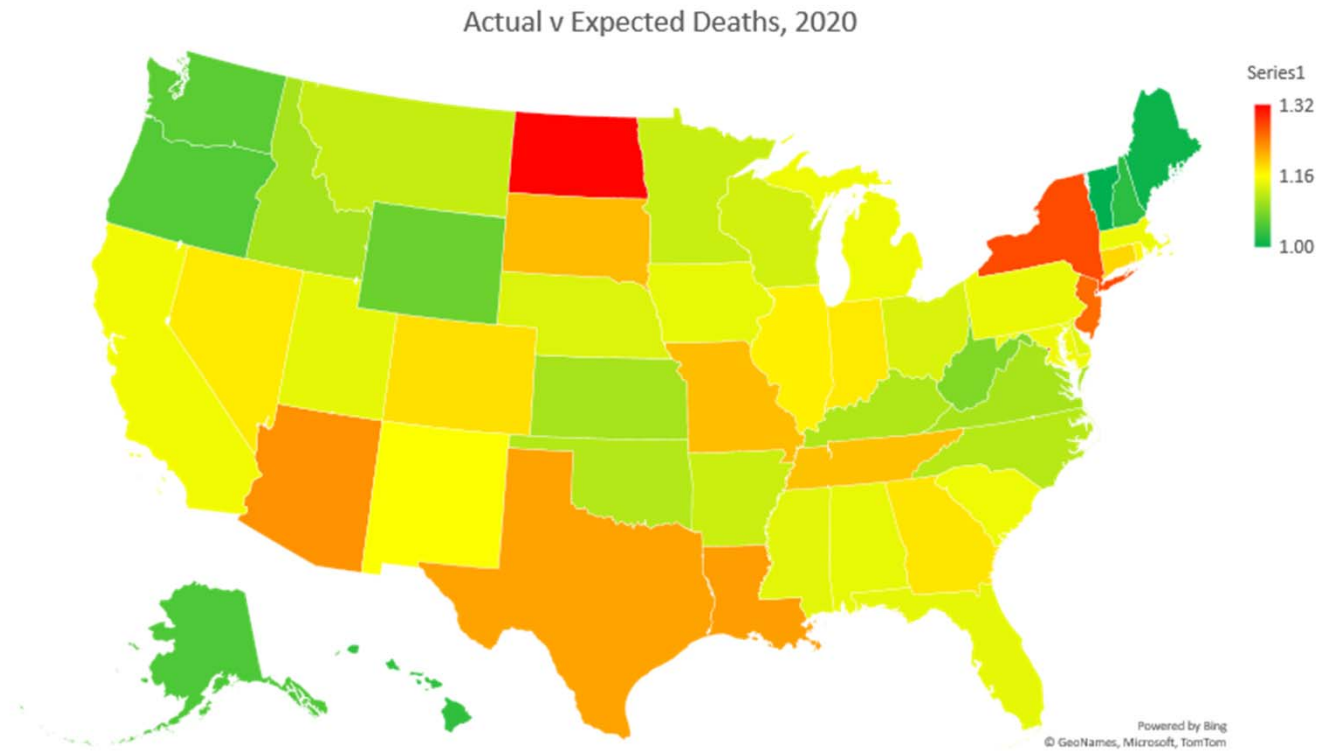


Change in Estimates - Week of October 22, 2021

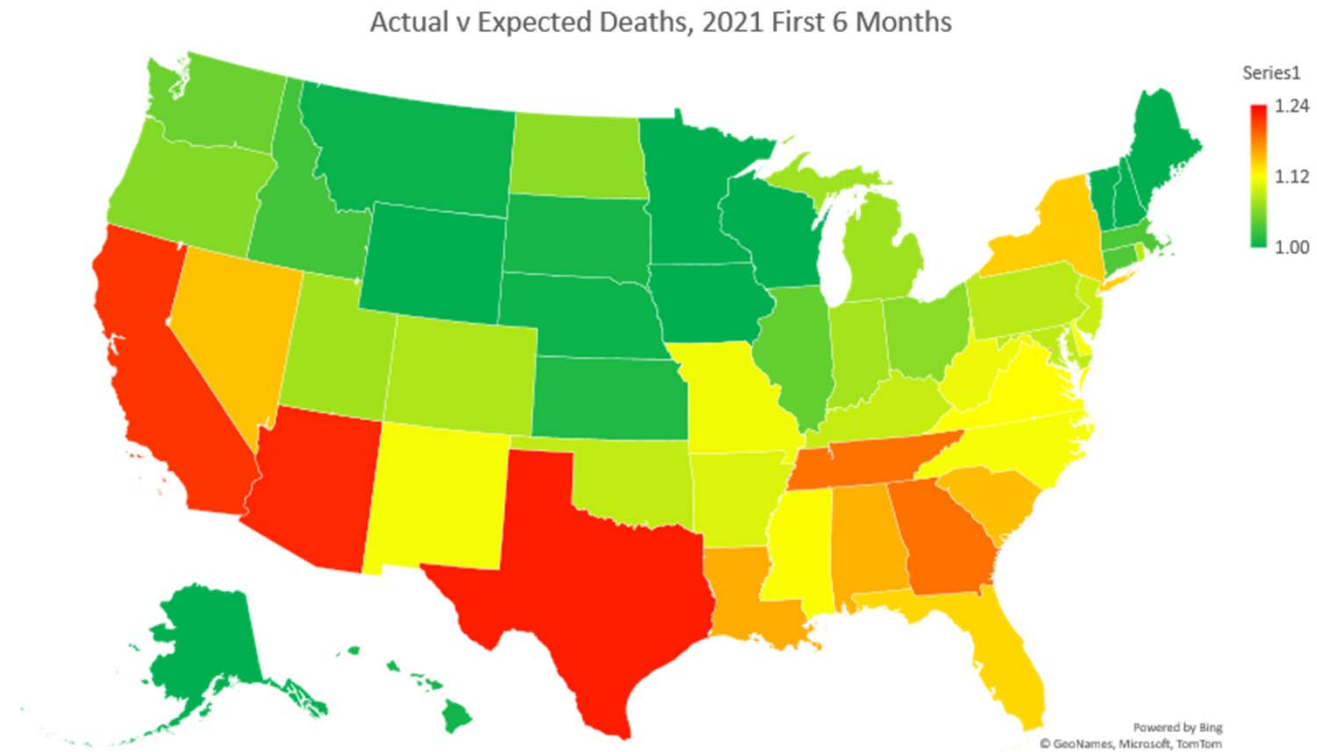


Excess

Excess Deaths 2020

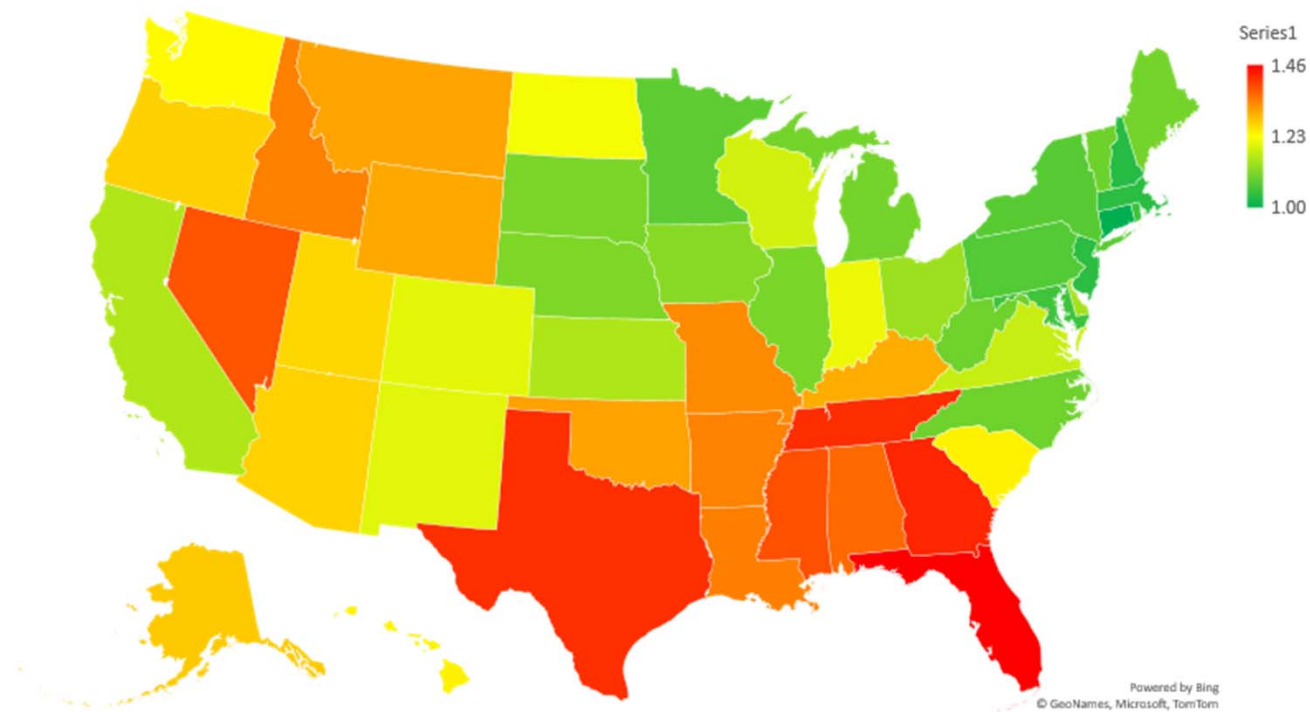


Excess Deaths 2021 – First 6 Months

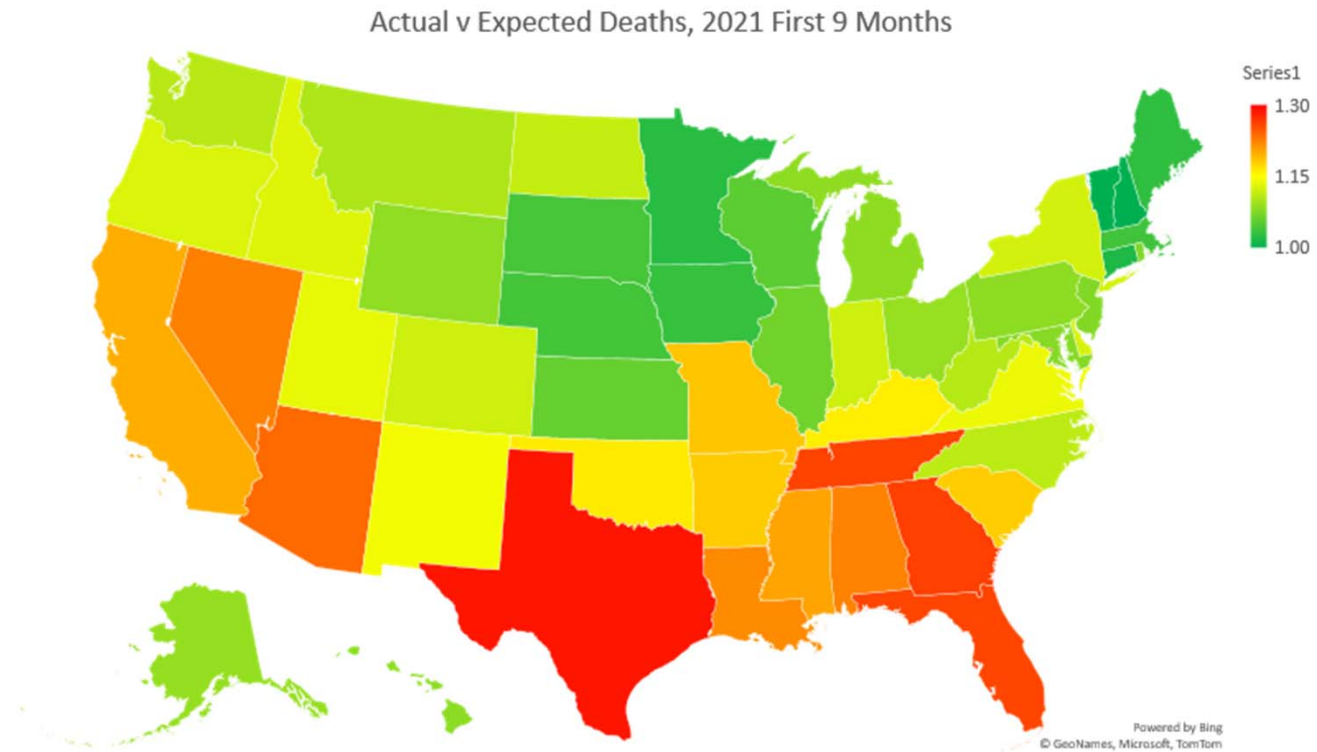


Excess Deaths 2021 – 3rd Quarter

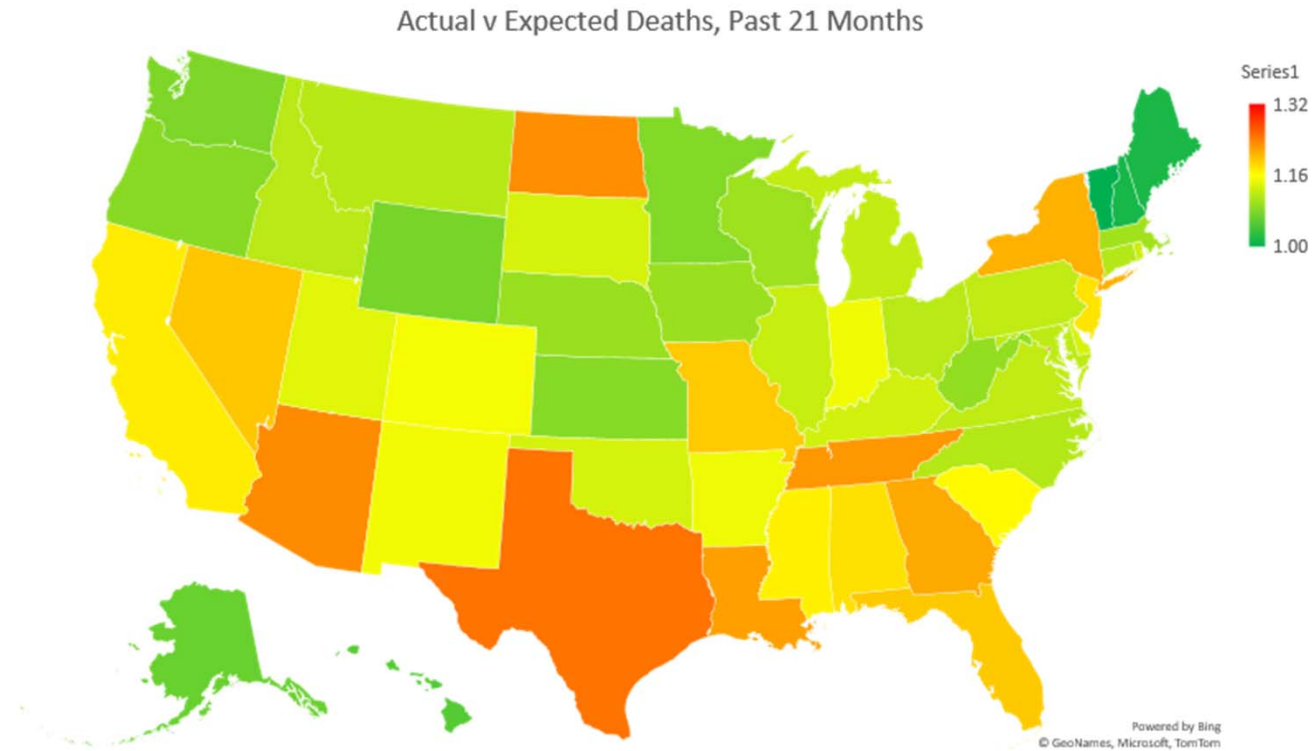
Actual v Expected Deaths, 2021 3rd Quarter



Excess Deaths 2021 – First 9 Months



Excess Deaths – 2020 & 2021 First 9 Months

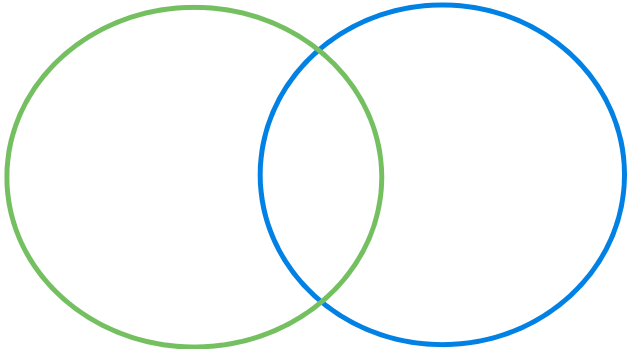


COVID

Are “COVID” Deaths Under or Over Reported?

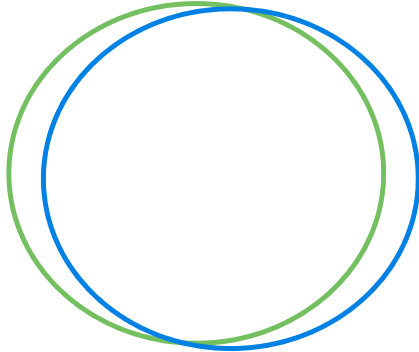
Died of COVID

Reported as COVID



Died of COVID

Reported as COVID



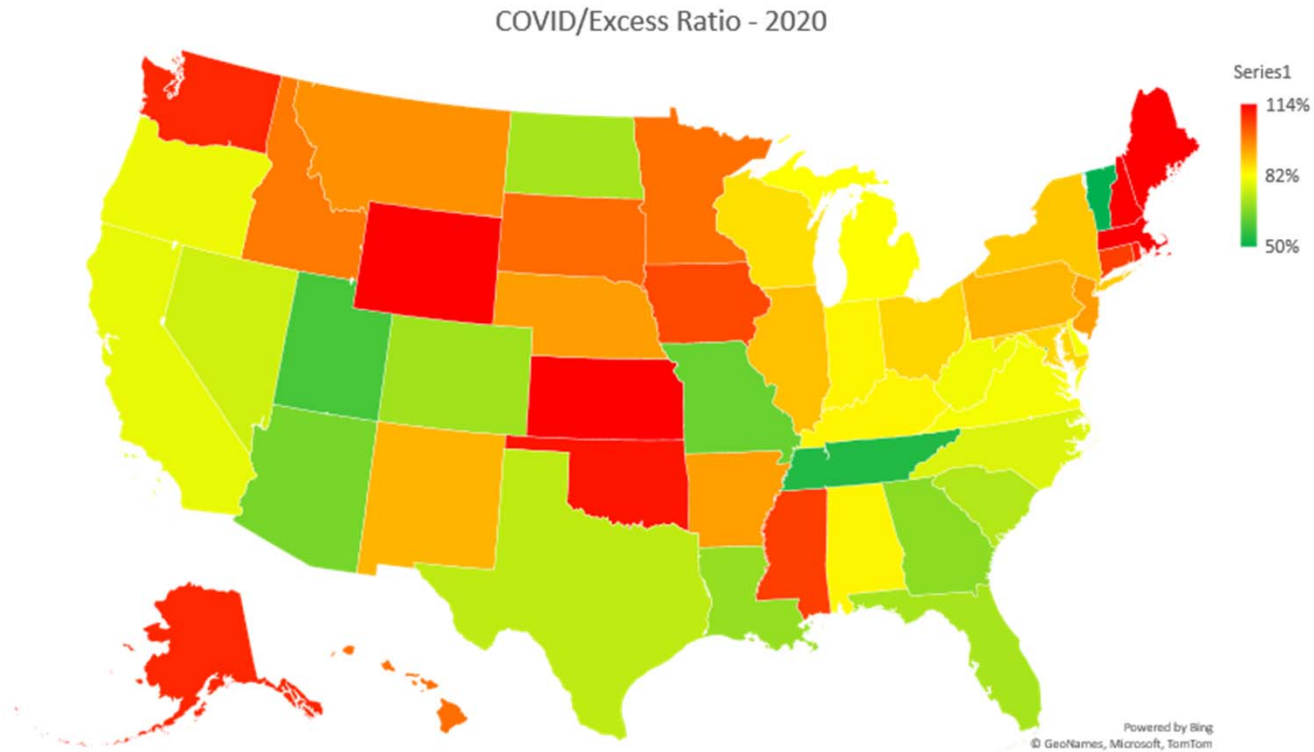
US COVID 2021

Month	Reported	DFU	Project	Total	Ratio	Select	Ultimate	DBNR
Jan	105,234	1.001	105,338	373,093	28.2%		105,338	104
Feb	48,343	1.001	48,415	282,111	17.1%		48,415	72
Mar	23,099	1.002	23,157	270,450	8.5%		23,157	58
Apr	18,636	1.004	18,719	256,325	7.3%		18,719	83
May	14,822	1.009	14,962	256,698	5.8%		14,962	140
Jun	7,881	1.016	8,005	241,082	3.3%		8,005	124
Jul	10,966	1.025	11,238	250,694	4.4%		11,238	272
Aug	46,956	1.046	49,099	290,218	16.2%		49,099	2,143
Sep	56,383	1.134	63,934	277,760	20.3%	19.8%	61,808	5,425
Oct						14.7%	42,667	42,667
Nov						14.7%	42,729	42,729
Dec						14.7%	46,336	46,336

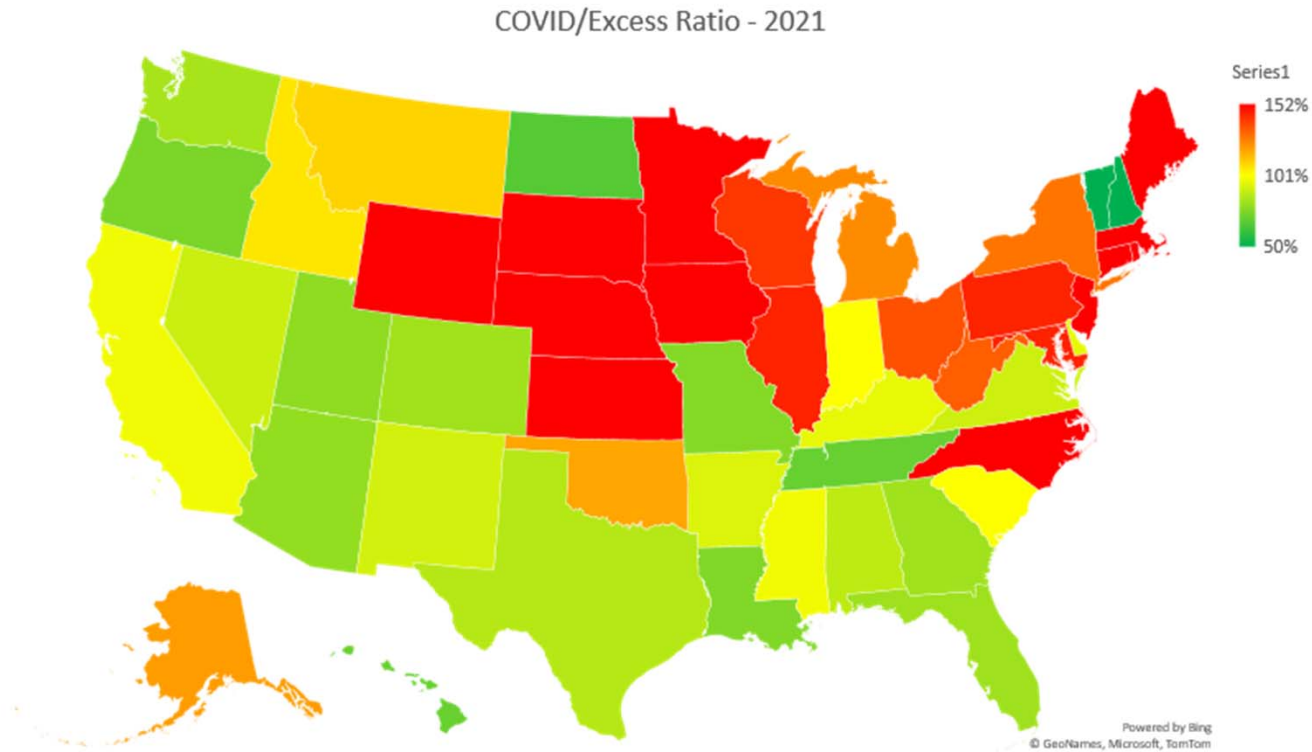
BF Ratio

<u>From</u>	<u>To</u>	<u>Relativity</u>	<u>COVID%</u>
Jul-20	Jun-21	1.17	13.8%
Jan-21	Jul-21	1.12	11.8%
Oct-20	Dec-20	1.27	18.7%
Average		1.19	14.7%
Select		1.19	14.7%

COVID/Excess Ratio - 2020



COVID/Excess Ratio – 2021



US vs Other Countries

See Supplement

Disclosures

Actuarial Principles and Concepts



Data

- Center for Disease Control (US)
 - <https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm>
 - Note: Provisional death counts are based on death certificate data received and coded by the National Center for Health Statistics as of October 1, 2021. Death counts are delayed and may differ from other published sources (see Technical Notes). Counts will be updated periodically. Additional information will be added to this site as available.
- Human Mortality Database
 - <https://www.mortality.org/>
 - “CDC” Type data for 35 countries
 - In response to the COVID-19 pandemic, the HMD team decided to establish a new data resource: **Short-term Mortality Fluctuations (STMF) data series**. Objective and internationally comparable data are crucial to determine the effectiveness of different strategies used to address epidemics. Weekly death counts provide the most objective and comparable way of assessing the scale of short-term mortality elevations across countries and time.

Thank You

- Craig Reynolds, Seattle Life
- Al Klein, Chicago Life
- Dr. Carol Bazell, New York Health
- Pamela Pelizzari, New York Health
- Ken Scalf, PCIS
- Dave Kennerud, Western Region P&C
- Glenn Leuteritz, Western Region P&C
- Marianne Harp, Western Region P&C



Thank you

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