COVID-19 Deaths A Look at U.S. Data FEB 2021 WORKING PAPER Genevieve Briand

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Genevieve Briand, Ph.D.
Assistant Director
MS in Applied Economics
Advanced Academic Programs
Johns Hopkins University
gbriand@jhu.edu

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February 2021

COVID-19 Deaths: A Look at U.S. Data

Summary

Readers are invited to write their own summary.

Introduction

Professor Hal R. Varian points out that ideas for research projects come as much from everyday life experiences than from review of previous work in academic journals (*19*). Everyone has been living COVID-19, but everyone's real life experience of it (as opposed to virtual), is unique. COVID-19 has inflicted an economic and societal toll that is still being measured. This paper concentrates on the effect of COVID-19 on U.S. deaths. For a comprehensive assessment of that effect, overall deaths and deaths due to select causes are analyzed. Graphs of weekly All Cause deaths across 2014-15—2019-20 seasons are also provided for each U.S. jurisdiction (50 states, District of Columbia, New York City and Puerto Rico territory). Readers are invited to consult them.

I would like to thank JHU Advanced Academic Programs for the opportunity to give the Nov. 11, 2020 webinar this paper is based on (*1*). This paper has not been peer-reviewed, nor is it endorsed by the Krieger School of Arts or Johns Hopkins University. It has been written and is being circulated to further discussion and comments on the original webinar. The data have been updated some, as more became available for more recent time periods. The analysis has also been expanded to individual U.S. jurisdictions.

I also would like to thank Dr. Lauren M. Rossen from the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), for patiently answering my questions about the CDC data contained in the datasets used for this analysis (*4*).

Thank you to Ms. Gu for covering the Nov. 11, 2020 webinar in her Nov. 22, 2020 JHU News-Letter Article, A Closer Look at U.S. deaths due to COVID-19 (*2*). Thank you to all who emailed me, for their interest, feedback and testimonies, as well as questions, I will try to address in this paper.

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1 Methodology

1.1 Overview

The methodology used for this analysis is very simple—put the data downloaded from publicly available CDC datasets in graphical or tabular form, and try to make sense of them. This analysis can easily be replicated by anyone who cares to do so. No statistical software per se, but a simple spreadsheet, was used. Microsoft Excel was chosen, but any spreadsheet software could be used. To guide the interpretation of the graphs and tables, the methodology adopted is to use simple statistics and logic. The objective of this analysis is not to produce an "excess deaths number estimate", but to assess whether the total deaths number the U.S. experienced in 2020 was unexpected or alarming.

In contrast, Roosen et al. produce excess deaths estimates, associated with COVID-19. Their results are presented in the October 23, 2020 Morbidity and Mortality Weekly Report (*5*). As explained on the CDC webpage that Rossen and her team maintain, the methodology they use is much more elaborate, "Estimates of excess deaths presented in this webpage were calculated using Farrington surveillance algorithms" (*7*).

The Center for Disease Control and Prevention (CDC) data are the best available data on U.S. deaths. The CDC indicates that the most recent deaths data made available are still provisional, and that is why the dates the datasets were downloaded are provided in table captions and list of references. The data presented in this paper are not estimates—they are records of past deaths, maintained and made publicly available by the CDC. They have not been produced, adjusted, nor tampered with, in any way, by the author.

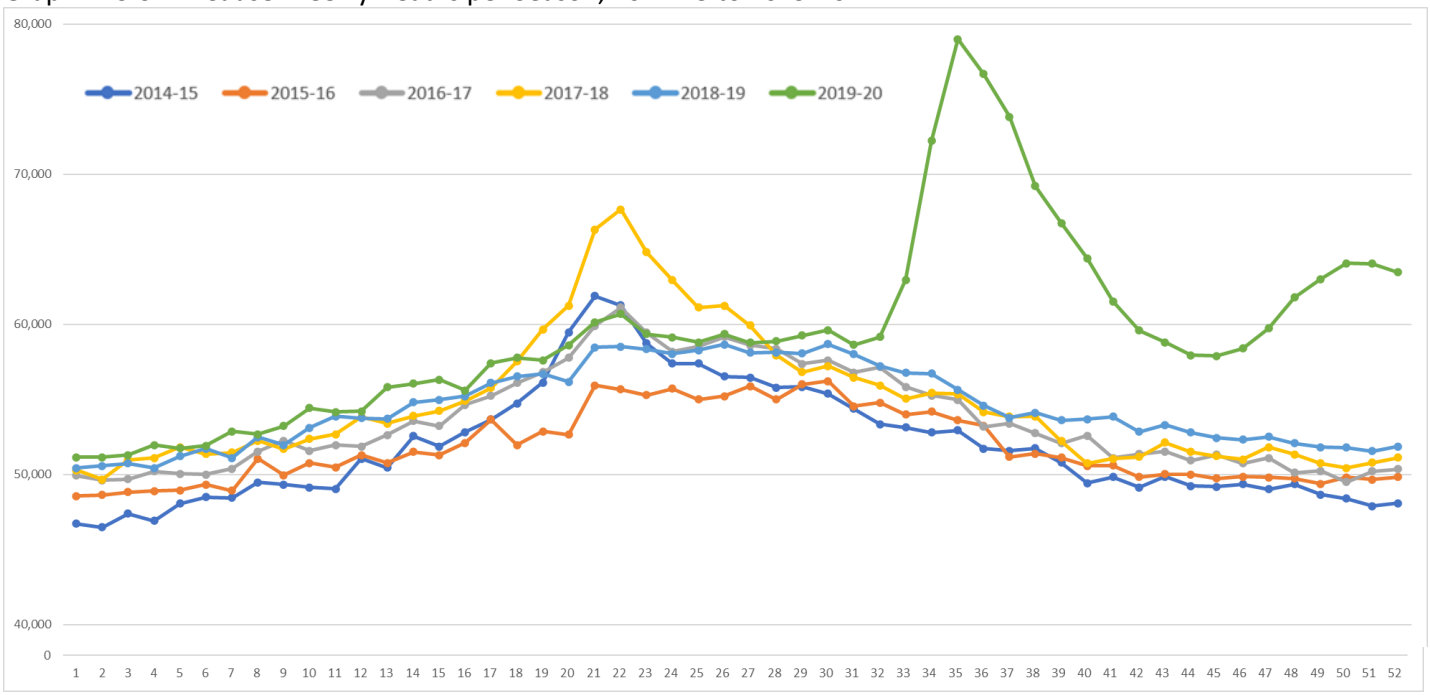
1.2 Line charts

Many visuals about COVID-19 deaths have been deceptive. Plots, or line charts, in this paper, can be too. The reason for this, is that plots present visuals of changes that cannot directly be interpreted as relevant proportions.

Graph 1: Visually accurate graphical representation of 1 percent death rate.

To illustrate, consider Graph 1. If the blue rectangle is defined as representing 100% of the U.S. population, then the pink line, at its top, represents 1% of it. Imagine the blue rectangle representing 100 blue lines, like the pink line atop, stacks up together. In other words, the surface area of the pink line represents 1% of the blue rectangle surface area. One could borrow a child's graph paper and colored pencils to reproduce a similar graph.

Graph 2: U.S. All Cause Weekly Deaths per Season, 2014-15 to 2019-20



In contrast, consider Graph 2. This is the plot of U.S. weekly All Cause deaths from season 2014-15 to season 2019-20 (why seasons are considered, and which weeks are included in each season and calendar year, are questions addressed in the upcoming data section). Graph 2 itself will be considered in further details in the upcoming "Weekly deaths per cause" section.

When you look at Graph 2, what is your interpretation of the extent of the change in All Cause deaths experienced by the U.S. during the 2019-20 season, compared to prior seasons? Is your read from Graph 2 that the total deaths number the U.S. experienced in 2019-20 was unexpected or alarming? Do you come up with a percentage death rate?

Please, take a second to answer these questions.

Can you read from Graph 2 that the All Cause deaths number in 2019-20 was 9.2% higher than in 2018-19? With a little bit of time, you could. Now, most importantly, can you read from Graph 2 that the death rate for season 2019-20 was 0.9%? No, you cannot. Because a death rate is a deaths number, in proportion of its population level, and you are missing a key piece of information—the 2019-20 population level. Note, a death rate of 0.9% is a usual death rate, one that has been experienced in recent years—more on that in the upcoming "US deaths: Short-term historic context" section.

Compare your answers to the previous questions, to the answers given above, and draw your own conclusion about whether Graph 2 was deceptive.

Despite the limitations of line charts, this tool will be used to analyze changes of death patterns across years and causes, in sections "Weekly deaths per cause: Seasonality" and "Weekly deaths per jurisdiction: Variability".

2 Data

2.1 CDC data sources

The data used and their sources are as follows:

- Data from page 2 of 2 of "Provisional Death Counts for Coronavirus Disease 2019 (COVID-19) By Week of Death" table, https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm. Downloaded 12-26-20. (*9*)
- "Weekly Counts of Deaths by State and Select Causes, 2014-2018" dataset found via https://data.cdc.gov/browse, https://data.cdc.gov/NCHS/Weekly-Counts-of-Deaths-by-State-and-Select-Causes/3yf8-kanr. Last updated by CDC Nov. 10, 2020. Downloaded 12-26-20. (*10*)
- "Weekly Counts of Deaths by State and Select Causes, 2019-2020" dataset found via https://data.cdc.gov/browse, https://data.cdc.gov/NCHS/Weekly-Counts-of-Deaths-by-State-and-Select-Causes/muzy-jte6. Last updated by CDC Dec. 23, 2020. Downloaded 12-26-20. (*11*)

2.2 Can the data be wrong?

The most recent CDC deaths data are still provisional. This is not an issue. It has always been the case. It is normal and understandable: Collecting and making U.S. deaths data available to the public, in a timely fashion, is quite an undertaking! The Center for Disease Control and Prevention (CDC) data are the best available data on U.S. deaths. Because the most recent deaths data made available are still provisional, the dates the datasets were downloaded are provided in table captions and list of references.

The reader, who cares to replicate this analysis, will download the data at a later date than the one they were downloaded at, for this paper. This means, because the most recent deaths data are still provisional, such reader might get slightly different numbers.

The care with which the CDC collects, keep records of and make publicly available deaths data, is not questioned here. Reporting errors, if any, are minimized by procedures adopted by the CDC.

The data presented in this paper are not estimates—they are records of past deaths, maintained and made publicly available, by the CDC. They have not been produced, adjusted, nor tampered with, in any way, by the author.

2.3 Can deaths be overcounted?

All deaths are assigned one and only one underlying cause of death (*4*).

"The International Classification of Diseases (ICD) is designed to promote international comparability in the collection, processing, classification, and presentation of mortality statistics", (*13*). The tenth revision (ICD-10) covers years from 1999 to the present (*14*). An online version of all ICD-10 codes is found on the World Health Organization's website (*20*); the latest version is the 2019 one (*21*).

Old age is not an underlying cause of death.

The new ICD code for COVID-19 deaths, ICD code U071, issued by the World Health Organization (WHO), was introduced and implemented by the Division of Vital Statistics of the U.S. National Center for Health Statistics (NCHS), on March 24, 2020 (*15*).

All Cause deaths are the actual number of dead bodies accounted for at one point in time and no dead body is double counted. When those numbers are not yet final, All Cause numbers may become higher, at a later date.

2.4 MMWR weeks

Table 1: MMWR weeks comprised within each calendar year, 2014-2020.

Year	1st MMWR Week ending date	Last MMWR Week ending date	Total MMWR weeks
2014	01/04/2014	01/03/2015	53
2015	01/10/2015	01/02/2016	52
2016	01/09/2016	12/31/2016	52
2017	01/07/2017	12/30/2017	52
2018	01/06/2018	12/29/2018	52
2019	01/05/2019	12/28/2019	52
2020	01/04/2020	01/02/2021	53

Deaths are recorded per Morbidity and Mortality Weekly Report (MMWR) week. "MMWR weeks" refers to the sequential numbering of weeks (Sunday through Saturday) during a calendar year (*12*). For MMWR year 2014, MMWR Week 1's ending date is 01/04/2014 and MMWR year 2014's last MMWR week is Week 53, ending 01/03/2015. Calendar year 2020 also has 53 MMWR weeks, while years 2015-2019, each have 52: See Table 1.

Table 2: MMWR weeks comprised within each season defined for this paper, 2014-15 to 2019-20.

Season	1st Week ending date	Last Week ending data	Total MMWR weeks
2014-15	08/23/2014	08/15/2015	52
2015-16	08/22/2015	08/13/2016	52
2016-17	08/20/2016	08/12/2017	52
2017-18	08/19/2017	08/11/2018	52
2018-19	08/18/2018	08/10/2019	52
2019-20	08/17/2019	08/08/2020	52

Because deaths are cyclical (something further analyzed in the upcoming section), another standard way to report deaths is over a season rather than a calendar year. For example, the CDC reporting period for influenza seasons begins during MMWR week 40 and ends MMWR week 39 of the following year. In this paper, seasons are centered around the 2014-19 peaks of deaths, to facilitate their comparison to the 2020 one, and address concerns that the same weeks were not compared across years during the Nov. 11, 2020 webinar (*1*)—see upcoming Seasonality of Deaths section. In upcoming Tables 5, 8 and Graphs 11-15, 17-69 and 71, deaths will be reported or plotted per season, instead of calendar year. Each season has 52 MMWR weeks: See Table 2.

2.5 Death causes

For each cause, deaths are recorded per MMWR week. All the causes/categories of death are not included in the datasets used here. The list of causes of death included in the datasets used here is:

- All Cause
- Natural Cause
- Septicemia (A40-A41)
- Malignant neoplasms (C00-C97)
- Diabetes mellitus (E10-E14)
- Alzheimer disease (G30)
- Influenza and pneumonia (J09-J18)
- Chronic lower respiratory diseases (J40-J47)
- Other diseases of respiratory system (J00-J06,J30-J39,J67,J70-J98)
- Nephritis, nephrotic syndrome and nephrosis (N00-N07,N17-N19,N25-N27)
- Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)
- Diseases of heart (I00-I09,I11,I13,I20-I51)
- Cerebrovascular diseases (I60-I69)
- COVID-19 (U071, Multiple Cause of Death)
- COVID-19 (U071, Underlying Cause of Death)

Influenza and pneumonia, chronic lower respiratory diseases, and other diseases of the respiratory system, are three old categories of respiratory diseases. COVID-19 is a new one.

All Cause deaths are total deaths.

All Cause are the sum of Natural Cause and Non-Natural Cause, or "external causes" deaths (*21*):

$$All\ Cause = Natural\ Cause + Non\text{-}Natural\ Cause$$

"Technically the natural causes are codes A-R, and external causes are V through Y. U-codes are 'codes for special purposes' and COVID-19 is U071, which we group in with the natural causes (*4*)".

Let **Old Select Cause** be the sum of deaths from the following old natural causes:

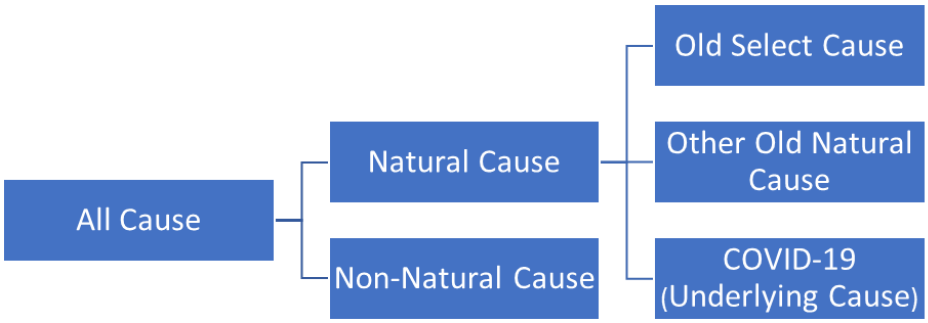
- Septicemia (A40-A41)
- Malignant neoplasms (C00-C97)
- Diabetes mellitus (E10-E14)
- Alzheimer disease (G30)
- Influenza and pneumonia (J09-J18)
- Chronic lower respiratory diseases (J40-J47)
- Other diseases of respiratory system (J00-J06,J30-J39,J67,J70-J98)
- Nephritis, nephrotic syndrome and nephrosis (N00-N07,N17-N19,N25-N27)
- Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)
- Diseases of heart (I00-I09,I11,I13,I20-I51)
- Cerebrovascular diseases (I60-I69)

Hereafter, in the text of this paper, malignant neoplasms will be referred to as cancers.

COVID-19 (U071, Underlying Cause of Death) deaths are a subset of COVID-19 (U071, Multiple Cause of Death) deaths: 5 to 13 % of deaths from weekly counts of COVID-19 (U071, Multiple Cause of Death) deaths have something other than COVID-19 specified as the underlying cause of death (*4*). Consequently, for this analysis, COVID-19 (U071, Underlying Cause of Death) deaths numbers are used.

Natural Cause deaths are the sum of deaths from Old Select Cause, Other Old Natural Cause deaths and COVID-19 (U071, Underlying Cause of Death):

$$Natural\ Cause = Old\ Select\ Cause + Other\ Old\ Natural\ Cause + COVID\text{-}19\ (Underlying\ Cause)$$



3 US deaths: Short-term historic context

The standard way the Centers for Disease Control and Prevention (CDC) and the National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS) report deaths is a rate by 100,000 population. These rates can be found reported in the NVSS mortality tables (*16*, *17*) and CDC WONDER tables (*18*), among other places.

The way the CDC and NCHS report deaths, as a rate, or proportion of a population, instead of, a number of deaths, makes a lot of sense. A number of deaths by itself is meaningless. For example, is 500,000 deaths an alarmingly high number of deaths? Well, it depends. If it is 500,000 deaths over a year, for a population that, at the beginning of the year, had 1 million individuals, then it would mean half of the population died. But if it is 500,000 deaths over a year, for a population, that, at the beginning of the year, was 100 times that (50 million individuals) then, it would mean 1% (1 per 100) of the population passed away that year.

Crude death rate per 100,000 population and percentage death rate (rate per 100 population) are defined as follows:

$$Crude\ Death\ Rate\ per\ 100,000\ Population = \left(\frac{Deaths}{Population}\right) * 100{,}000 \qquad \text{(Eq. 1)}$$

$$Percentage\ Death\ Rate\ (or\ Rate\ per\ 100\ Population) = \left(\frac{Deaths}{Population}\right) * 100 \qquad \text{(Eq. 2)}$$

Table 3: U.S. death rates per 100,000 population and per 100 population (or percentage death rates), years 1999-2019

Year	Deaths	Population	Crude Rate per 100,000	Percentage Death Rate
1999	2,391,399	279,040,168	857.0	0.9
2000	2,403,351	281,421,906	854.0	0.9
2001	2,416,425	284,968,955	848.0	0.8
2002	2,443,387	287,625,193	849.5	0.8
2003	2,448,288	290,107,933	843.9	0.8
2004	2,397,615	292,805,298	818.8	0.8
2005	2,448,017	295,516,599	828.4	0.8
2006	2,426,264	298,379,912	813.1	0.8
2007	2,423,712	301,231,207	804.6	0.8
2008	2,471,984	304,093,966	812.9	0.8
2009	2,437,163	306,771,529	794.5	0.8
2010	2,468,435	308,745,538	799.5	0.8
2011	2,515,458	311,591,917	807.3	0.8
2012	2,543,279	313,914,040	810.2	0.8
2013	2,596,993	316,128,839	821.5	0.8
2014	2,626,418	318,857,056	823.7	0.8
2015	2,712,630	321,418,820	844.0	0.8
2016	2,744,248	323,127,513	849.3	0.8
2017	2,813,503	325,719,178	863.8	0.9
2018	2,839,205	327,167,434	867.8	0.9
2019	2,854,838	328,239,523	869.7	0.9

Source: https://wonder.cdc.gov/ucd-icd10.html; tables organized by year, generated February 1st 2021.

The first four columns from Table 3 were generated using CDC WONDER by choosing to organize the table layout by year (*18*). The last column was computed using (Eq. 2). According to Table 3, U.S. death rates have been from 0.8% to 0.9%, each year, from 1999 to 2019. A difference of 0.1 percent point in the death rate of one year over another has been observed in the recent past and is thus to be expected.

A difference of 0.1 percent point in the death rate for a population of 330 million is 330,000 deaths (C 1). For a population of 330 million with a death rate of 0.9%, the expected number of deaths is 3.0 million per year or 8,137 deaths per day (C 2-3). An additional 0.1 percent point in the death rate would bring the expected number of deaths for a population of 330 million to 3.3 million per year or 9,041 deaths per day (C 4-5).

$330{,}000{,}000\ (0.1/100) = 330{,}000$ deaths: 0.1 % of a population of 330 million (C 1)

$330{,}000{,}000\ (0.9/100) = 2{,}970{,}000$ deaths per year (C 2)

$2{,}970{,}000/365 = 8{,}137$ deaths per day (C 3)

$330{,}000{,}000\ (1.0/100) = 3{,}300{,}000$ deaths per year (C 4)

$3{,}300{,}000/365 = 9{,}041$ deaths per day (C 5)

Table 4: U.S. death rates per 100,000 population and per 100 population (or percentage death rates), years 2014-2020

Year	Deaths	Population	Crude Rate per 100,000	Percentage Death Rate
2014	2,646,843	317,344,917	834.1	0.8
2015	2,698,943	319,680,287	844.3	0.8
2016	2,731,848	321,969,165	848.5	0.8
2017	2,810,935	324,157,064	867.2	0.9
2018	2,839,076	325,991,287	870.9	0.9
2019	2,852,609	327,598,547	870.8	0.9
2020	3,382,503	329,197,954	1027.5	1.0

Source: https://www.census.gov/popclock/, consulted February 1st 2021, January 20th population numbers. https://data.cdc.gov/browse , Weekly Counts of Deaths by State and Select Causes, for 2014-19. Page 2 of 2 of "Provisional Death Counts for Coronavirus Disease 2019 (COVID-19) By Week of Death" table, https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm, for 2020.

Because one needs a population number to compute a death rate against and because Table 3 does not show a death rate for calendar year 2020, Table 4 uses different sources of information, to include a death rate for year 2020. Population data for Table 4 were retrieved from the U.S. Census Bureau Population Clock (*6*), for January 20th of each year. Death data were computed as the sum of weekly All Cause deaths numbers for each calendar year, from the CDC Weekly Counts of Deaths by State and Select Causes datasets (*8*, *10*, *11*).

Table 5: U.S. death rates per 100,000 population and percentage death rates, season 2014-15 to season 2019-20

Season	Deaths	Population	Crude Rate per 100,000	Percentage Death Rate
2014-15	2,698,735	319,680,287	844.2	0.8
2015-16	2,695,241	321,969,165	837.1	0.8
2016-17	2,789,845	324,157,064	860.6	0.9
2017-18	2,843,558	325,991,287	872.3	0.9
2018-19	2,832,269	327,598,547	864.6	0.9
2019-20	3,093,240	329,197,954	939.6	0.9

Source: See Table 4.

Because deaths are cyclical (something further analyzed in the upcoming section), another standard way to report deaths is over a season rather than a calendar year. For example, the CDC reporting period for influenza seasons begins during Morbidity and Mortality Weekly Report (MMWR) week 40 and ends week 39 of the following year, where "MMWR weeks" refers to the sequential numbering of weeks (Sunday through Saturday) during a calendar year (*12*). In this paper, seasons are centered around the 2014-19 peaks of deaths, to facilitate their comparison to the 2020 one, and address concerns that the same weeks were not compared across years during the Nov. 11, 2020 webinar (*1*)—see upcoming section about the seasonality of deaths. Each season has a total of 52 weeks of reported deaths. A season starts MMWR week 33 and ends MMWR week 32—except for the 2014-15 season which starts MMWR week 34 and ends MMWR week 32. Table 5 uses the same data source as Table 4, but does group U.S. deaths per season rather than calendar year. Season 2014-15 spans from week ending 8/23/2014 to week ending 8/15/2015. Season 2015-16 spans from week ending 8/22/2015 to week ending 8/13/2016. Season 2016-17 spans from week ending 8/20/2016 to week ending 8/12/2017. Season 2017-18 spans from week ending 8/19/2017 to week ending 8/11/2018. Season 2018-19 spans from week ending 8/18/2018 to week ending 8/10/2019. Season 2019-20 spans from week ending 8/17/2019 to week ending 8/08/2020.

Population estimates from Table 3 (CDC WONDER table) are U.S. Census Bureau estimates of July 1 resident populations (see Dataset Documentation, (*18*))—mid-year: This makes sense. For example, over the calendar year 1999, the US experienced 2,391,399 deaths. A total of 2,391,399 deaths experienced by a population of 279,040,168 individuals, means the death rate that year was 0.9%.

Now, because the objective of this analysis is to assess whether the total deaths number the U.S. experienced during the course of the 2020 calendar year or 2019-20 season was unexpected or alarming, July 1, for the U.S. population, cannot be the reference. Indeed, by July 1, 2020 the US population level would potentially have been altered by COVID-19. So, instead, the date chosen for population levels in Tables 4-5, is January 20th—pre-COVID-19. The interpretation of the data does not change though. Over the calendar year 2020, the U.S. experienced 3,382,503 deaths. Given that the U.S. started the year with a population of 329,197,54 individuals, this means the U.S. death rate was 1.0%.

The percentage death rates shown in Tables 3-5 range from 0.9% to 1.0%. Percentage death rates shown in Table 3, which covers years from 1999 to 2019, went from 0.9% to 0.8%, and back to 0.9%, in the past. A difference of 0.1 percent point in the death rate of one year over another has been observed in the recent past and is thus to be expected. Tables 3-5's population data and death rates show that total deaths experienced in the U.S. during season 2019-20 and year 2020 were normal, within the U.S. historical context reviewed here.

Table 6: U.S. percentage death rates, percentage change in deaths, percentage change in population, years 1999-2019

Year	Deaths	change	% change	Population	change	% change	% Death Rate
1999	2,391,399			279,040,168			0.9
2000	2,403,351	11,952	0.5	281,421,906	2,381,738	0.9	0.9
2001	2,416,425	13,074	0.5	284,968,955	3,547,049	1.3	0.8
2002	2,443,387	26,962	1.1	287,625,193	2,656,238	0.9	0.8
2003	2,448,288	4,901	0.2	290,107,933	2,482,740	0.9	0.8
2004	2,397,615	-50,673	-2.1	292,805,298	2,697,365	0.9	0.8
2005	2,448,017	50,402	2.1	295,516,599	2,711,301	0.9	0.8
2006	2,426,264	-21,753	-0.9	298,379,912	2,863,313	1.0	0.8
2007	2,423,712	-2,552	-0.1	301,231,207	2,851,295	1.0	0.8
2008	2,471,984	48,272	2.0	304,093,966	2,862,759	1.0	0.8
2009	2,437,163	-34,821	-1.4	306,771,529	2,677,563	0.9	0.8
2010	2,468,435	31,272	1.3	308,745,538	1,974,009	0.6	0.8
2011	2,515,458	47,023	1.9	311,591,917	2,846,379	0.9	0.8
2012	2,543,279	27,821	1.1	313,914,040	2,322,123	0.7	0.8
2013	2,596,993	53,714	2.1	316,128,839	2,214,799	0.7	0.8
2014	2,626,418	29,425	1.1	318,857,056	2,728,217	0.9	0.8
2015	2,712,630	86,212	3.3	321,418,820	2,561,764	0.8	0.8
2016	2,744,248	31,618	1.2	323,127,513	1,708,693	0.5	0.8
2017	2,813,503	69,255	2.5	325,719,178	2,591,665	0.8	0.9
2018	2,839,205	25,702	0.9	327,167,434	1,448,256	0.4	0.9
2019	2,854,838	15,633	0.6	328,239,523	1,072,089	0.3	0.9

Source: See Table 3.

Table 7: U.S. percentage death rates, percentage change in deaths, percentage change in population, years 2014-2020

Year	Deaths	change	% change	Population	change	% change	% Death Rate
2014	2,646,843			317,344,917			0.8
2015	2,698,943	52,100	2.0	319,680,287	2,335,370	0.7	0.8
2016	2,731,848	32,905	1.2	321,969,165	2,288,878	0.7	0.8
2017	2,810,935	79,087	2.9	324,157,064	2,187,899	0.7	0.9
2018	2,839,076	28,141	1.0	325,991,287	1,834,223	0.6	0.9
2019	2,852,609	13,533	0.5	327,598,547	1,607,260	0.5	0.9
2020	3,382,503	529,894	18.6	329,197,954	1,599,407	0.5	1.0
2021				330,835,933	1,637,979	0.5	

Source: See Table 4.

Table 8: U.S. percentage death rates, percentage change in deaths and change in population, season 2014-15 to 2019-20

Season	Deaths	change	% change	Population	change	% change	% Death Rate
2014-15	2,698,735			319,680,287			0.8
2015-16	2,695,241	-3,494	-0.1	321,969,165	2,288,878	0.7	0.8
2016-17	2,789,845	94,604	3.5	324,157,064	2,187,899	0.7	0.9
2017-18	2,843,558	53,713	1.9	325,991,287	1,834,223	0.6	0.9
2018-19	2,832,269	-11,289	-0.4	327,598,547	1,607,260	0.5	0.9
2019-20	3,093,240	260,971	9.2	329,197,954	1,599,407	0.5	0.9

Source: See Table 5.

Further consider Tables 6-8. Tables 6-8 contain the same deaths and population data as Tables 3-5, and consequently the same percentage death rates. Nothing has changed—all the deaths, population and death rate numbers from Table 3 and, now Table 6, are from the CDC's WONDER table (*18*); deaths and population numbers from Tables 4-5, and now Tables 7-8, are from the CDC (*8*, *10*, *11*) and the U.S. Census Bureau (6)—while death rates were computed based on those, the exact same way they are on the CDC WONDER tables (*18*). Tables 6-8 include only the percentage death rates, to leave room for the change in deaths and population numbers from one calendar or season, over another, and the expression of those changes in percentage terms. Note, the January 20th 2021 population level is added to Table 7 (it was not included in Table 5).

Changes in deaths and population, as well as percentage changes in deaths and population were computed as follows:

$$Change\ in\ Deaths = Year\ 2\ deaths - Year\ 1\ deaths \qquad \text{(Eq. 3)}$$

$$Percentage\ change\ in\ Deaths = \left(\frac{Change\ in\ deaths}{Year\ 1\ deaths}\right) * 100 \qquad \text{(Eq. 4)}$$

$$Change\ in\ Population = Year\ 2\ population - Year\ 1\ population \qquad \text{(Eq. 5)}$$

$$Percentage\ change\ in\ Population = \left(\frac{Change\ in\ population}{Year\ 1\ population}\right) * 100 \qquad \text{(Eq. 6)}$$

The first thing to notice is that the U.S. population has not decreased during calendar year 2020 (Table 7). In other words, COVID-19 deaths have not decimated the U.S. population. Instead, in 2020, the U.S. population increased by 0.5 percent over the previous year—just like it did for the two years prior to that. It is the fact that the US population has increased over the years, that explains the increase of deaths numbers over the years. The more people, the more of them pass away. The change in population over the years is the reason why the relevant statistics, to assess whether deaths experienced in 2020 were unexpected or alarming, are death rates. A death rate is a deaths number in proportion to its population level. A death rate does account for the increase in population over the years.

Tables 7-8 show the percentage changes in population ranged from +0.7% for earlier years or seasons to + 0.5 this past three years. Those percentage changes are slightly different on Table 6, since the population numbers they are based on, are slightly different. The percentage changes in deaths vary a lot more, ranging from -2.1% from 2003 to 2004 (Table 6) to +2.9% from 2016 to 2017 (Table 7) or +3.5% from season 2015-16 to 2016-17 (Table 8). With + 9.2% (2018-19 to 2019-20, Table 8), or + 18.6% (2019 to 2020, Table 7), this past season and year; these numbers would seem odd—if it was not for the relevant percentage death rates telling us otherwise.

The emphasis is on—*if it was not for the relevant percentage death rates telling us otherwise*.

In other words, while Table 8 shows a change of +260,971 deaths from season 2018-19 to season 2019-20 and table 7 shows a change of +529,894 deaths from calendar year 2019 to calendar year 2020, given the level and change in population over the same periods, those deaths numbers are normal—as the respective death rates of 0.9% and 1.0% show.

The death rates show that the total deaths increase experienced in 2020 was not unexpected, nor alarming, but rather, is explained by the population increase. Note, this result, in conjunction with the facts that (1) every recorded death is allocated one exclusive cause, (2) a new cause was especially created for COVID-19 and, (3) means to test and record COVID-19 deaths were considerably expanded, points to suspicions that some reclassification between other causes of death and COVID-19 deaths might have occurred.

Also, note, it is not assumed, or even suggested, that such re-classification, if they occurred, were malicious or intended to inflate COVID-19 numbers. Nonetheless, individuals within organizations do respond to financial incentives and groupthink, to some extent. Similarly, it is not assumed, or even suggested, that mitigation measures adopted were designed to harm targeted groups of the U.S. population. Nonetheless, the unequal toll that those measures have had on individuals across our society cannot be ignored.

3.1 How about excess deaths estimates?

Back in October 20, 2020, the CDC published estimates by the National Center for Health Statistics (NCHS) of "299,028 excess deaths from late January through October 3th 2020, with two thirds attributed to COVID-19" (5). This begs the question: How can those results be reconciled with the above conclusions?

The objective of this analysis is to assess whether the total deaths number the U.S. experienced in 2020 was unexpected or alarming. In contrast, Rossen et al. *take as given* that COVID-19 had effects of pandemic proportion on U.S. deaths and question whether COVID-19 deaths numbers were underestimated. They then, set themselves to produce excess deaths estimates, (*5*):

> As of October 15, 216,025 deaths from coronavirus disease 2019 (COVID-19) have been reported in the United States; however, this number might underestimate the total impact of the pandemic on mortality. Measures of excess deaths have been used to estimate the impact of public health pandemics or disasters, particularly when there are questions about underascertainment of deaths directly attributable to a given event or cause.

The methodology used here is simple and transparent: Put publicly available CDC data of past deaths into tabular and graphical forms and use simple logic and statistics to make sense of them. In contrast, Rossen et al. produce estimates of excess deaths, using Farrington surveillance algorithms.

In the discussion part of their paper, Rossen and co-authors allude to one of the reasons why their results seem to contradict the conclusions reached here that total deaths experienced in the U.S. in 2020 were not unexpected nor alarming. Rossen et al. point out that, because of population growth over the years, using the average number of deaths from past years as a benchmark, like they do—overestimates excess deaths, (5). This is the fourth limitation of their findings:

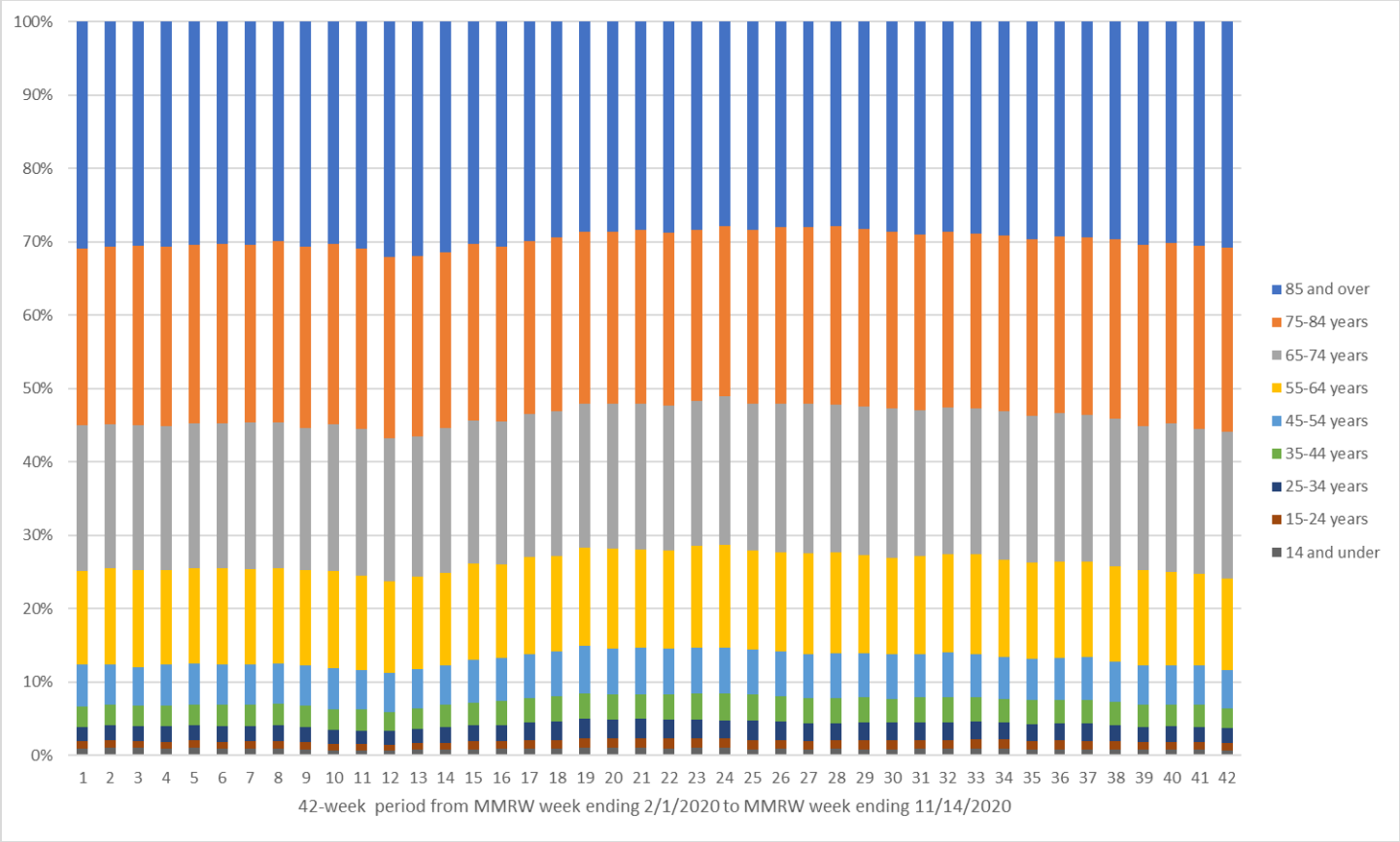
> The findings in this report are subject to at least five limitations. Fourth, using the average numbers of deaths from past years might underestimate the total expected numbers because of population growth or aging, or because of increasing trends in certain causes such as drug overdose mortality.

Because they defined excess deaths as "the number of persons who have died from all causes, in excess of the expected number of deaths for a given place and time" (5), when they state in the discussion part of their paper that they "might underestimate the expected number of deaths", what they are saying is, they might have overestimated excess deaths. In other words, the model used to produce their excess deaths estimates did not account for the increase in population over the years. In contrast, by using death rates, which are simple statistics anyone who cares to do so can compute, this analysis does account for the increase in population over the years.

4 Weekly deaths per age group: Constancy

Looking at the distribution of deaths across age groups is important. If a new disease is more fatal to one age group compared to another (despite mitigation efforts adopted), this will be reflected in a higher percentage of total deaths from that age group. If a new disease is equally fatal to all age groups, then the distribution of deaths across age groups will remain constant.

Graph 3: Percentage of U.S. Deaths per Age Group, from MMWR week ending 2/1/2020 to week ending 11/14/2020



Source: Page 2 of 2 of "Provisional Death Counts for Coronavirus Disease 2019 (COVID-19) By Week of Death" table, https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm. Downloaded 12-26-20.

Graph 3 is a 100% stacked column graph. It is used to compare the percentages across age groups that each contributes towards the total weekly deaths. Each column represents 100% of all deaths experienced that week. Each colored chunk of each column represents the portion or percentage of those deaths experienced by its corresponding age group. The data for this graph were downloaded on December 26, 2020. Because "data for the most recent 5 weeks are typically less than 90% complete, with lower levels of completeness in more recent weeks" (9), those most recent 5 weeks of data were omitted from this graph. Graph 3 includes 42 weeks of data, from MMWR Week 1 ending 02/01/2020 to MMWR Week 42 ending 11/14/2020. This time period covers the weeks since the U.S. started recording COVID-19 deaths, March 24th 2020, and also pre-COVID weeks. For a corresponding of week number (from 1 to 42) to the date the week ended, please see Table 9.

Table 9: Week ending date (MM-DD-YY) corresponding to week number, Graph 3

season	2019-2020												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	02-01-20	02-08-20	02-15-20	02-22-20	02-29-20	03-07-20	03-14-20	03-21-20	03-28-20	04-04-20	04-11-20	04-18-20	04-25-20
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	05-02-20	05-09-20	05-16-20	05-23-20	05-30-20	06-06-20	06-13-20	06-20-20	06-27-20	07-04-20	07-11-20	07-18-20	07-25-20
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	08-01-20	08-08-20	08-15-20	08-22-20	08-29-10	09-05-20	09-12-20	09-19-20	09-26-20	10-03-20	10-10-20	10-17-20	10-24-20
Week #	40	41	42										
ending date	10-31-20	11-07-20	11-14-20										

Notice Graph 3's pattern of total deaths across age groups: The percentages of total deaths from each age group are fairly constant throughout all those weeks. The chunks of blue columns have approximately the same height throughout all those weeks. This means that every week, 30% of all deaths are from individuals who were 85 years old or older. That is true for the other age groups as well. Throughout the weeks, every week, 25% of all deaths are from individuals who were from 75 to 84 years old. And so on.

Table 10: Average Weekly U.S. Deaths from MMWR week ending 2/1/2020 to week ending 11/14/20, per Age Group

Age Group	Average Weekly Deaths	Percentage
All ages	62,084	100%
85 and over	18,473	30%
75-84 years	14,985	24%
65-74 years	12,344	20%
55-64 years	8,152	13%
45-54 years	3,565	6%
35-44 years	1,962	3%
25-34 years	1,392	2%
15-24 years	681	1%
14 and under	531	1%

Source: See Graph 3.

Every week, all age groups experience deaths. No one age group escapes this reality. Table 10 indicates that 531 individuals, 14 years and younger, pass away every week in the United States. An average of 62,084 individuals died per week in the United States, between week ending 02/01/2020 and week ending 11/14/2020. The good news is, every week, a much lower number of younger individuals pass away than the number of older individuals who pass away. That is good news.

Data from Graph 3 and Table 9 point to the reason a higher number of COVID-19 deaths has been reported among older individuals than younger individuals, is simply because, every day in the U.S., COVID-19 or not, those aged 85 or older are at a higher risk of dying than those aged 84 or younger. This should come as no surprise to anyone.

Family and friends mourn the passing of their loved ones, no matter their age at the time of their passing. The passing of a loved one can be, devastating. Nonetheless, as a society, the passing of older individuals should not be something to dread or fear, but instead, to celebrate—long lives lived are something to be grateful for and worth celebrating.

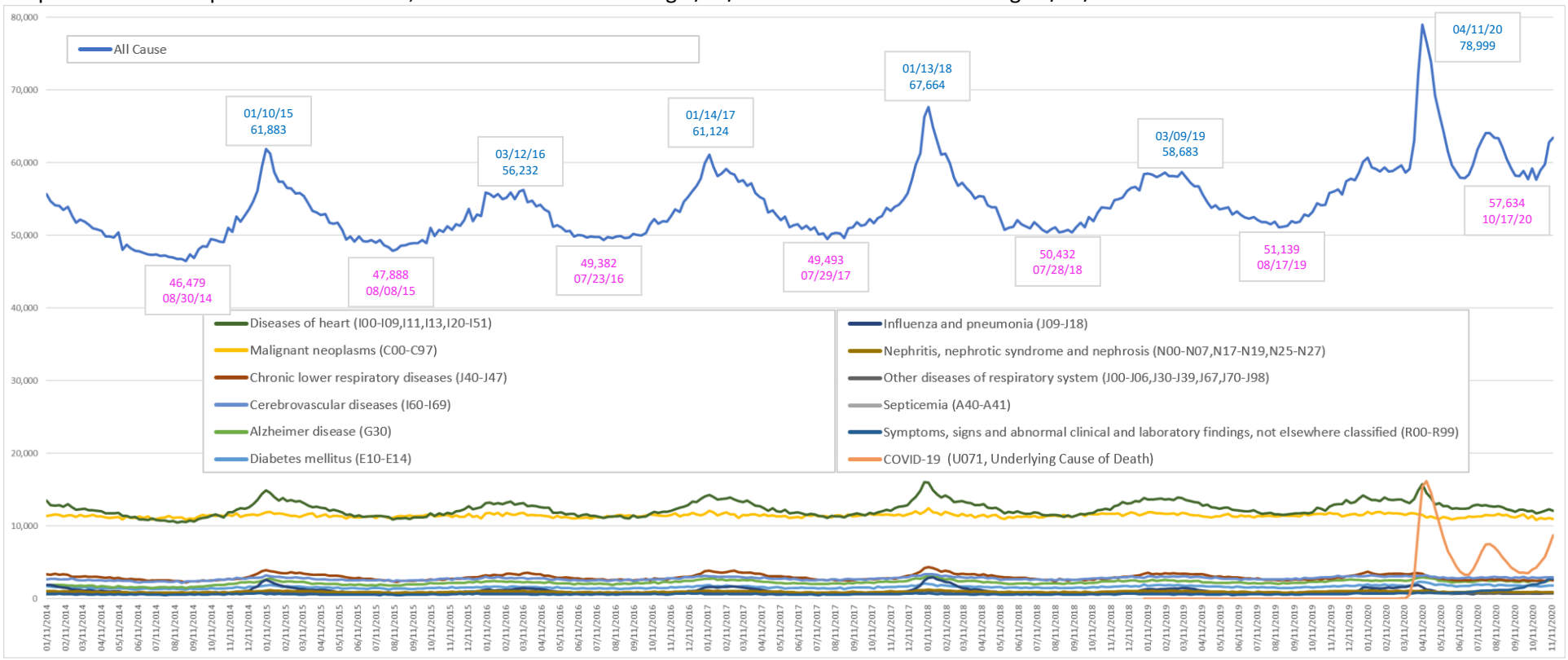
While the general pattern of Graph 3 has not changed over the weeks shown, those of you with eagle eyes might have noticed the percentage of weekly deaths from the 85 and over age group increased to reach a high of 32.1%, week 12, which corresponds to MMWR week ending 04/18/2020—the week with the highest number of total deaths of all ages in spring 2020. Could this change in the age distribution of deaths, at the U.S. level, reflect the abrupt increase in deaths from New York City and the State of New Jersey experienced during those weeks (see US deaths per jurisdiction section)? More work is needed to determine what effect COVID-19 *and* mitigation efforts have had on deaths, on how it might have differed, across age groups, as well as U.S. jurisdictions.

In the next section, the seasonality of weekly deaths across causes is addressed.

5 Weekly deaths per cause: Seasonality

5.1 Seasonality of Deaths across Causes

Graph 4: U.S. Deaths per Week and Cause, from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020

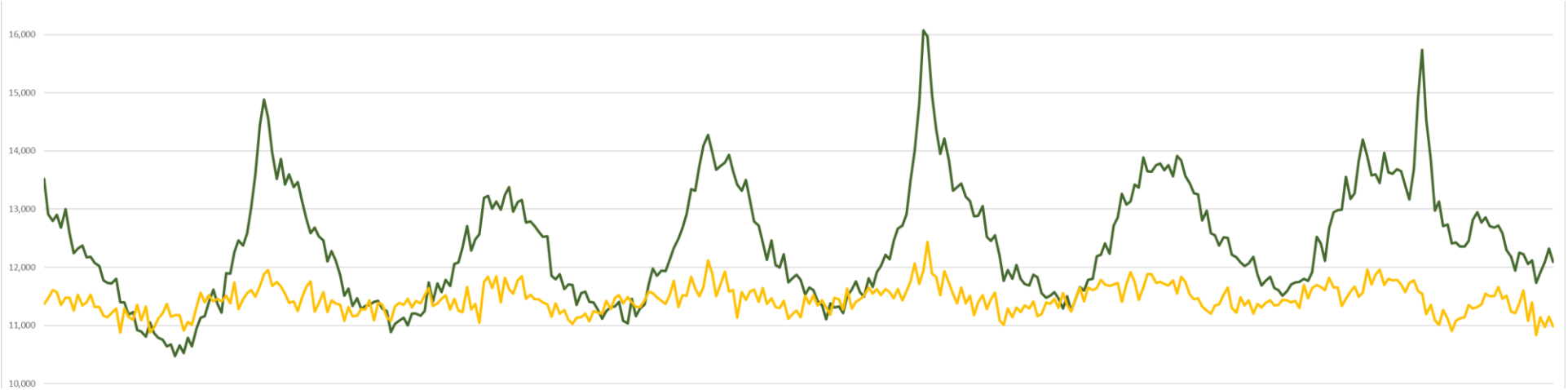


Graph 4 is the plot of weekly U.S. deaths per cause, from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020, a total of 358 weeks. The blue line is the plot of weekly deaths from all causes. The first two lines below that, are the plots of weekly deaths due to heart diseases and cancers, the two main causes of death in the United States. Note, the third leading cause of death is respiratory diseases. The bottom cluster of lines are plots of weekly deaths due to other select causes on record in the datasets used here. Those datasets, labeled "Weekly Counts of Deaths by State and Select Causes", are publicly available CDC datasets and the same ones used to get Tables 4-5 and 7-8's deaths numbers (*10*, *11*).

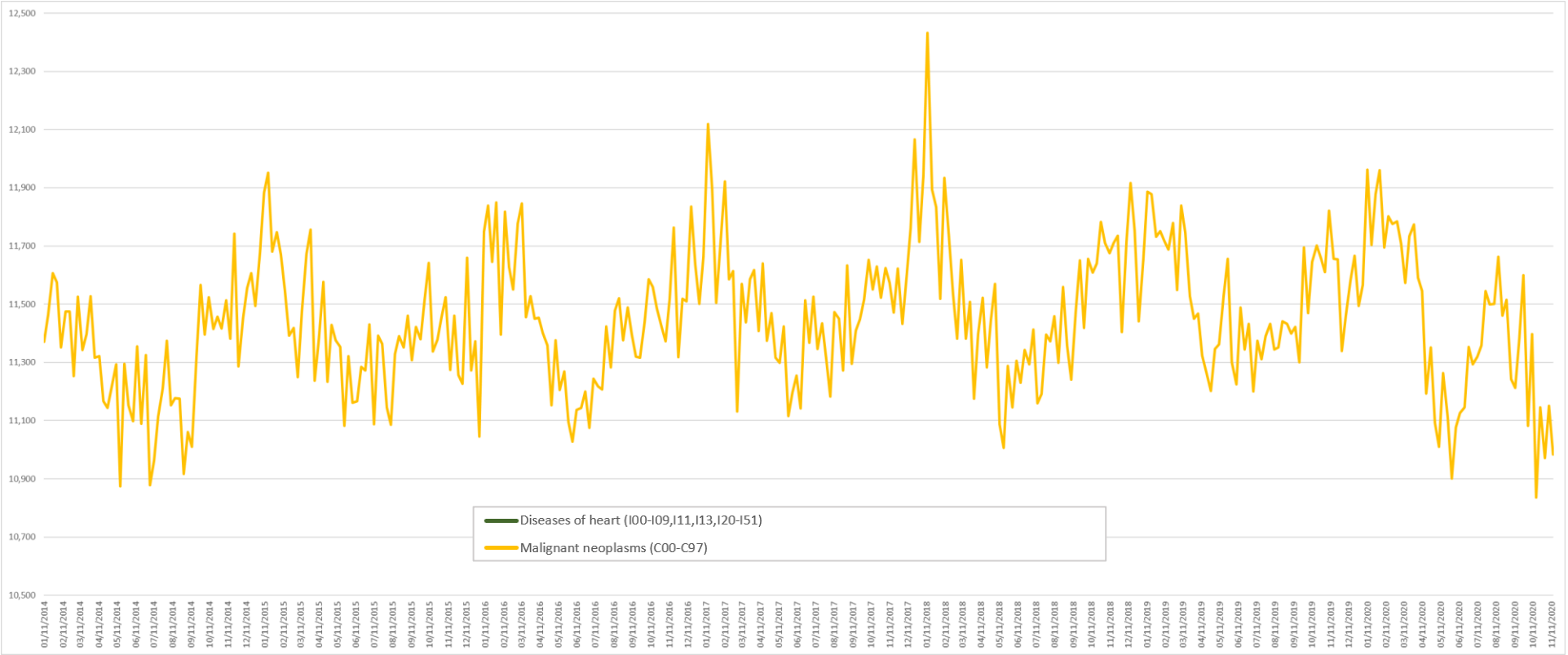
Weekly U.S. deaths numbers, highs and lows, seem to be seasonal, occurring at similar time intervals, over the period shown on Graph 4. The All Cause weekly U.S. deaths blue line shows an upward sloping trend, which is consistent with the increasing deaths numbers over the years shown in Tables 3-8. This trend can most clearly be identified by the troughs consistently going up, despite the peaks going up and down, over the years.

From Graph 4, the seasonality of deaths is more striking with the All Cause line. It can also be discerned for deaths due to heart diseases, chronic lower respiratory diseases as well as influenza and pneumonia. The scale of the graph, chosen to accommodate All Cause deaths numbers, as well as its clutter, might obscure seasonality of deaths occurring for other select causes. Next, in Graphs 5-10, this possibility is investigated. To get a clearer picture of this seasonality, the data series corresponding to the newly introduced category of death "COVID-19" is taken off those graphs.

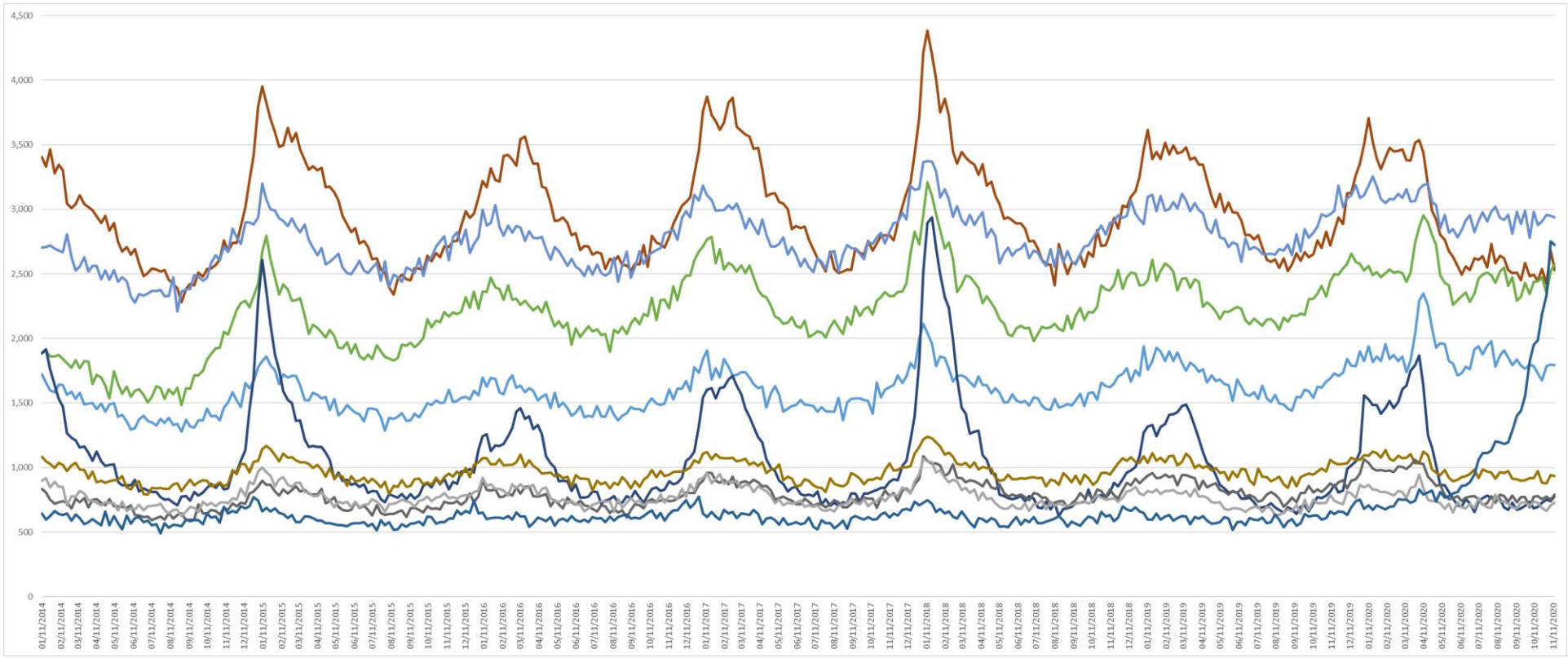
Graph 5: Heart diseases and cancers, U.S. Weekly Deaths from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020



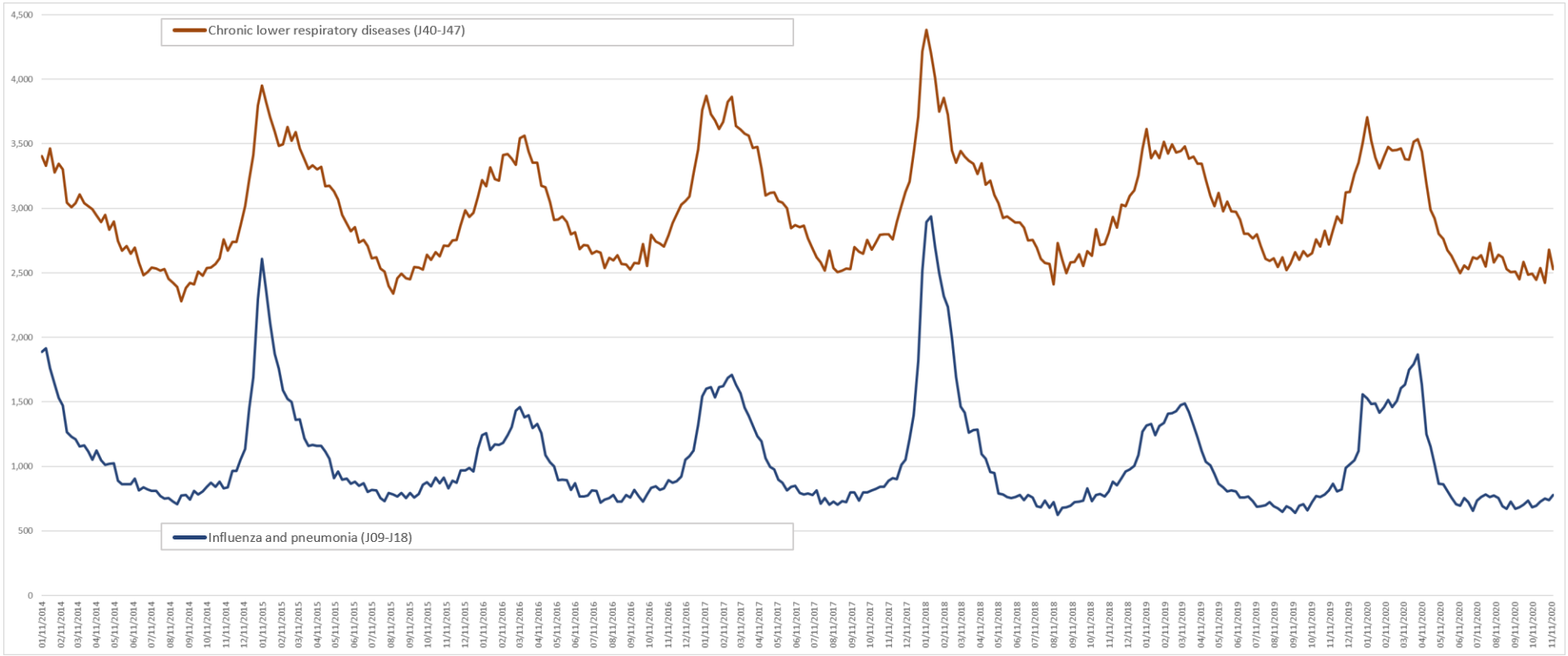
… change in scale



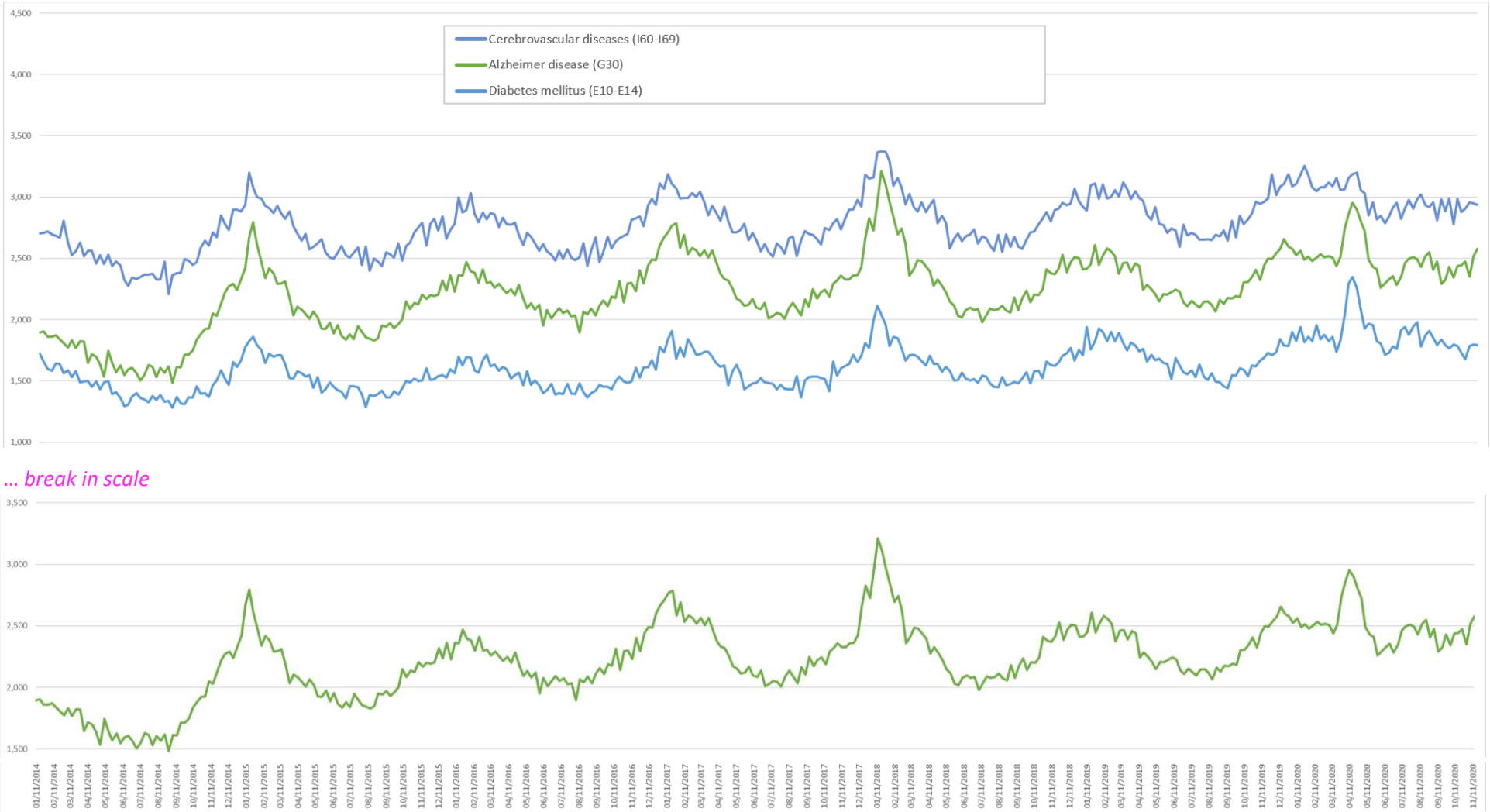
Graph 6: Less than 4,500 deaths/week causes, U.S. Weekly Deaths from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020



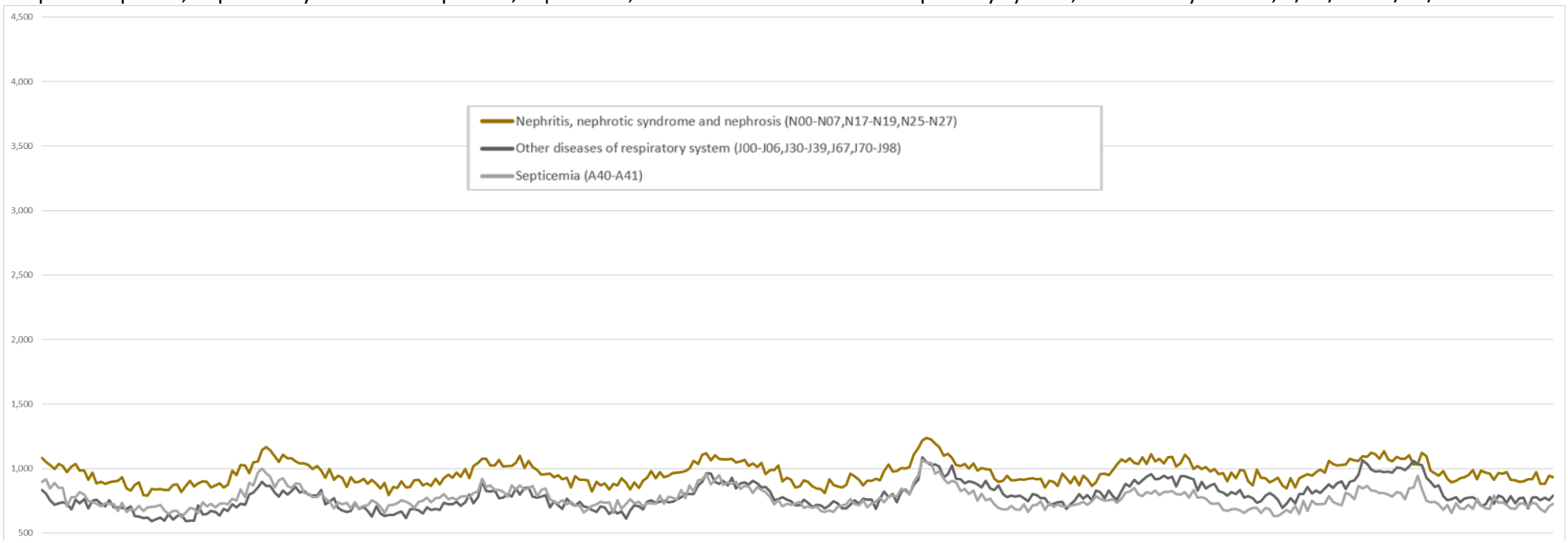
Graph 7: Chronic lower respiratory diseases and influenza & pneumonia, U.S. Weekly Deaths from week ending 1/11/2014 to 11/14/2020



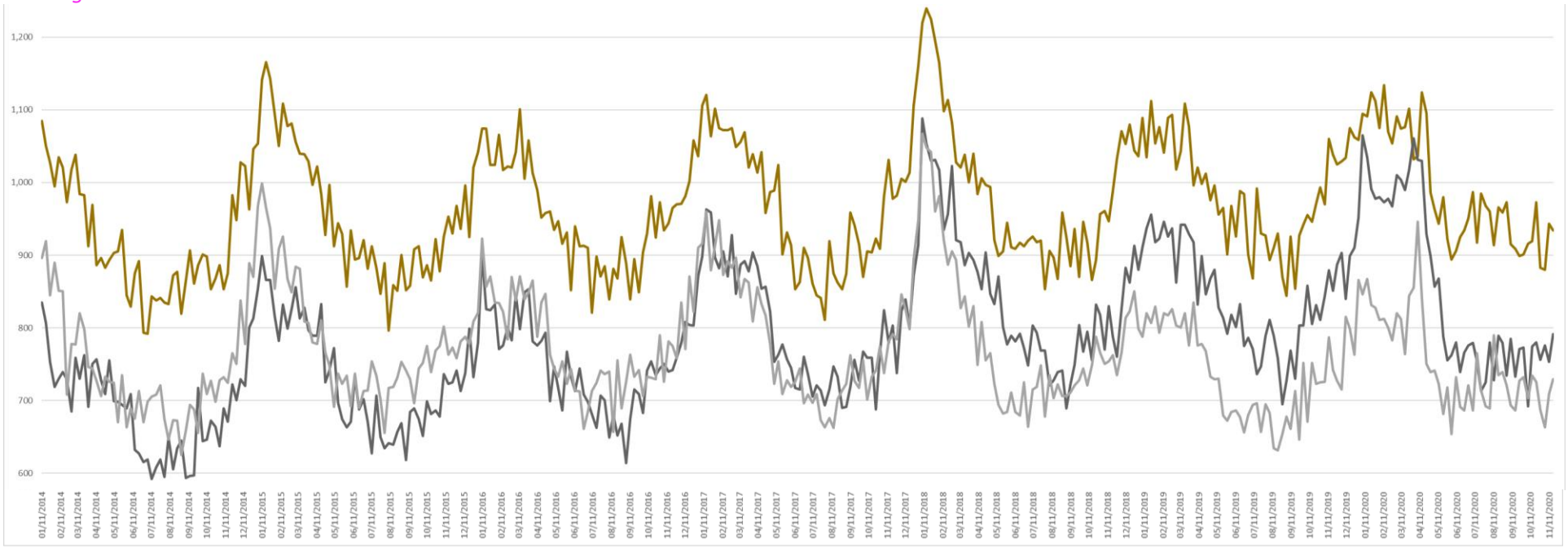
Graph 8: Cerebrovascular diseases, Alzheimer's, and diabetes U.S. Weekly Deaths from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020



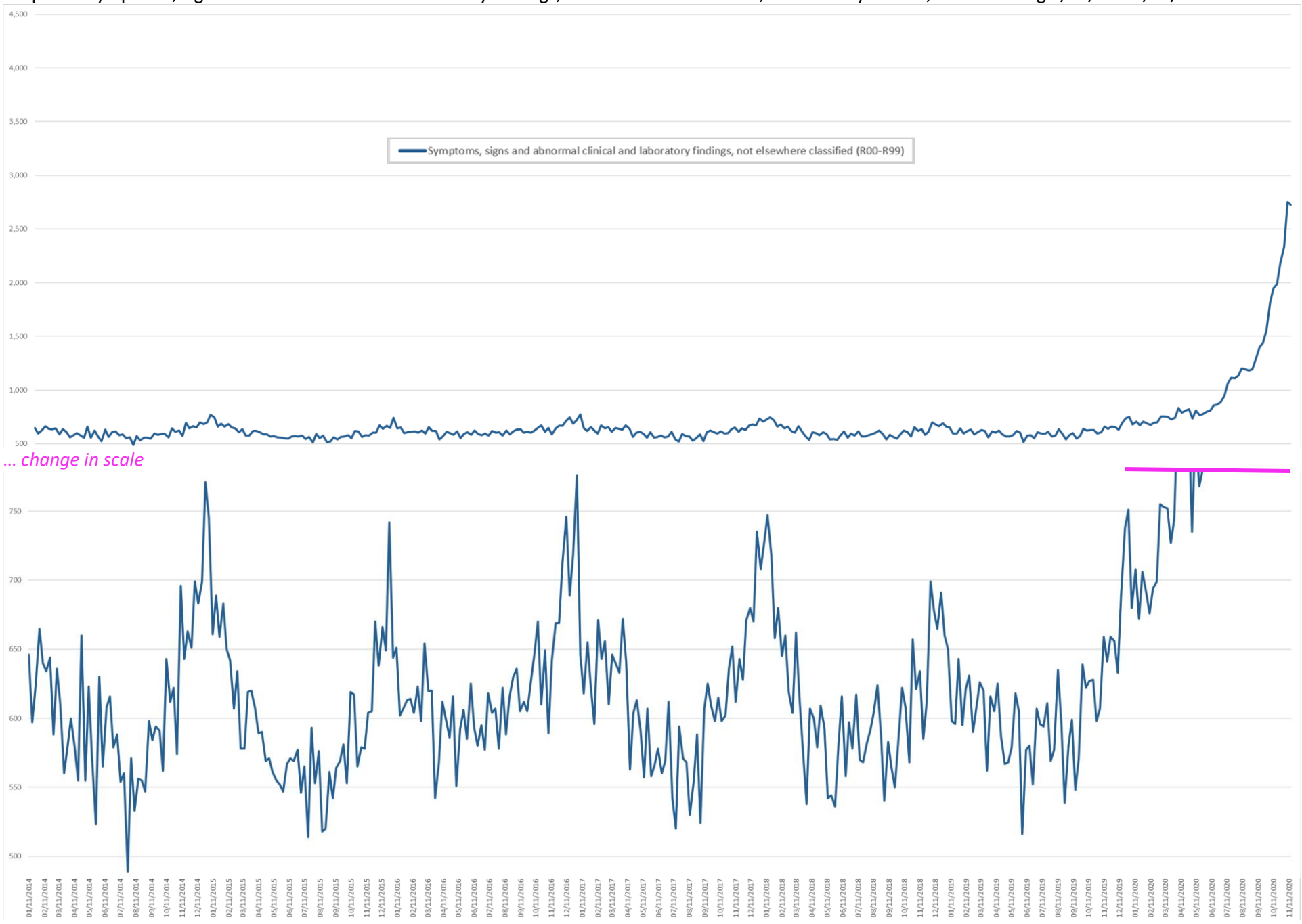
Graph 9: Nephritis, nephrotic syndrome & nephrosis, septicemia, and other diseases of the respiratory system, U.S. Weekly Deaths, 1/11/14-11/14/20



… change in scale



Graph 10: Symptoms, signs & abnormal clinical & laboratory findings, not elsewhere classified; U.S. Weekly Deaths, weeks ending 1/11/14-11/14/20



Graph 5 takes a closer look at deaths due to heart diseases and cancers. Graph 6, which has the plots of data series for causes with less than 4,500 deaths per week, is further declutter and/or rescaled on Graphs 7-10. Graphs 5-10 reveal that all old select causes of deaths are characterized by the seasonality first observed on Graph 4, with peaks of deaths occurring during the same weeks across years and causes of death. This is quite amazing.

Deaths have followed a pattern of highs and lows, year after year, and the magnitude of those highs and lows, one year relatively to another, has been consistent for each and every select cause of death. In other words, the peaks of deaths, from all the different causes, have coincide (happened over the same weeks)—year after year, and the magnitude of those peaks for one year relative to another, for each cause, has also been consistent across causes. But not for 2020. Why?

Does the historically observed seasonality point to general conditions, usually reoccurring in winters, that make individuals more vulnerable and at a higher risk of dying, no matter what their underlying health conditions may be? Could some of those general conditions have prevailed "off-season", in 2020? Could have mitigation efforts artificially created some of those general conditions, which are harmful to individuals' health and increase their risk of dying?

Table 11: Copy of Table from Nov. 11, 2020 COVID-19 Deaths: A Look at U.S. Data, webinar

Change in Deaths over previous week	Week ending 4/11/2020	Week ending 4/18/2020	Week ending 4/25/2020
Heart Diseases	+ 824	- 1,190	- 727
Cancers	- 52	- 356	- 160
Chronic Respiratory	- 96	- 249	- 211
Cerebrovascular	+ 35	+ 11	- 145
Alzheimer	- 86	- 56	- 96
Diabetes	+ 52	- 90	-179
Flu & Pneumonia	- 236	- 381	- 97
Nephritis	+ 88	- 31	- 106
Other Respiratory	- 4	- 95	- 31
Septicemia	- 98	- 92	- 13
Not Classified	- 44	+ 13	+ 48
TOTAL DECREASE	**- 530**	**- 2,540**	**- 1,605**
COVID – Heart Diseases	**+ 486**	**+ 2,561**	**+ 1,651**

For each cause, the magnitude of those peaks for one year relative to another, being consistent across causes, means that, when the 2020 peak of weekly deaths caused by heart diseases is smaller than its 2018 one, while the 2020 peak for All Cause is higher than its 2018 one, it is not consistent with observed historical patterns—and it points to an anomaly. This prompted the question, where have all the heart attacks gone? (*1*)

During the webinar this paper is based on, Table 11 was presented. Table 11 looks at the changes in deaths numbers from select causes from one week over another, over the three weeks the U.S. experienced the highest COVID-19 deaths numbers. The sum of the decreases in deaths numbers across causes was then compared to the number by which COVID-19 deaths exceeded the deaths due to heart diseases. And lo and behold, those two nearly matched—which gave suspicions that some re-classification between various select causes of death and COVID-19 might have occurred. Many found this result intriguing while, for some, this measure did not make sense. Dr. Shrestha argued it was just a coincidence (*3*). A few asked whether such results held true for later weeks too.

Now, these results cannot possibly hold true for weeks-on, because the number of COVID-19 deaths did not continue to increase week after week, and the number of weekly deaths due to other select causes never goes to zero (or below of course). There is a seasonality to the number of deaths the U.S. experiences from all the different select causes reviewed here—but no matter the cause, the deaths numbers never go to zero. That is worth emphasizing. The lowest number of weekly deaths due to respiratory diseases (influenza and pneumonia + chronic lower respiratory diseases + other diseases of the respiratory system) has been 3,699 deaths per week over the 358 weeks period from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020. Why should we expect weekly deaths due to COVID-19 to go to zero?

An alternative to the measure adopted in Table 11 must be found. As stated before, because there is, historically, synchronicity of the relative increases of death peaks across year, for all causes, one death peak (for a specific select cause) not increasing as much as expected could be an indication that some re-classification, between this select cause and the newly introduced COVID-19 cause, occurred. On the other hand, could, one death trough (for a specific select cause) not decreasing as much as expected, indicate that mitigation efforts (isolation, lockdowns, …) have taken a toll on individuals and put them at a higher risk of dying from such specific select causes, such as diabetes or suicides?

To get a clearer picture of those potential changes, that might have occurred, we turn to the comparison of weekly deaths per cause, across seasons. Doing so also facilitates the comparison of the past peaks of deaths to the 2020 one, and addresses concerns that the same weeks were not compared across years, during the Nov. 11, 2020 seminar (*1*).

5.2 Causes of Deaths across Seasons

Although weekly deaths exhibit seasonal patterns (see sub-section on Seasonality of Deaths across Causes), every peak of weekly deaths and every trough does not occur at the exact same week year after year. Nonetheless, the peaks have occurred in the winter and the troughs have occurred in the summer: From 2014 to 2019, peaks occurred from MMWR week ending January 10th to MMWR week ending March 12th, and troughs occurred from MMWR week ending July 23rd to MMWR week ending August 30th. But in 2020 (see Graph 4), the peak of deaths occurred MMWR week ending April 11th and the trough occurred MMWR week ending October 17th. This in itself is puzzling. This could also mean comparing the 2020 peak to previous ones might be misleading, as it occurred "off-season". To address this, instead of comparing peaks to peaks, seasons are compared to seasons. The seasons are delineated by defining their centers around the 2014-19 peaks of deaths—since the objective here is to assess whether the 2020 peak was unexpected or alarming.

All seasons have a total of 52 weeks of reported deaths. A season starts MMWR week 33 and ends MMWR week 32—except for the 2014-15 season which starts MMWR week 34 and ends MMWR week 32. Season 2014-15 spans from week ending 8/23/2014 to week ending 8/15/2015. Season 2015-16 spans from week ending 8/22/2015 to week ending 8/13/2016. Season 2016-17 spans from week ending 8/20/2016 to week ending 8/12/2017. Season 2017-18 spans from week ending 8/19/2017 to week ending 8/11/2018. Season 2018-19 spans from week ending 8/18/2018 to week ending 8/10/2019. Season 2019-20 spans from week ending 8/17/2019 to week ending 8/08/2020.

Table 12a: Week ending date (MM-DD-YY) corresponding to week number on Graphs 2, 11-15, 19-71 and 73, for each season

season	2014-2015												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-23-14	08-30-14	09-06-14	09-13-14	09-20-14	09-27-14	10-04-14	10-11-14	10-18-14	10-25-14	11-01-14	11-08-14	11-15-14
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-22-14	11-29-14	12-06-14	12-13-14	12-20-14	12-27-14	01-03-15	01-10-15	01-17-15	01-24-15	01-31-15	02-07-15	02-14-15
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-21-15	02-28-15	03-07-15	03-14-15	03-21-15	03-28-15	04-04-15	04-11-15	04-18-15	04-25-15	05-02-15	05-09-15	05-16-15
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-23-15	05-30-15	06-06-15	06-13-15	06-20-15	06-27-15	07-04-15	07-11-15	07-18-15	07-25-15	08-01-15	08-08-15	08-15-15

season	2015-2016												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-22-15	08-29-15	09-05-15	09-12-15	09-19-15	09-26-15	10-03-15	10-10-15	10-17-15	10-24-15	10-31-15	11-07-15	11-14-15
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-21-15	11-28-15	12-05-15	12-12-15	12-19-15	12-26-15	01-02-16	01-09-16	01-16-16	01-23-16	01-30-16	02-06-16	02-13-16
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-20-16	02-27-16	03-05-16	03-12-16	03-19-16	03-26-16	04-02-16	04-09-16	04-16-16	04-23-16	04-30-16	05-07-16	05-14-16
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-21-16	05-28-16	06-04-16	06-11-16	06-18-16	06-25-16	07-02-16	07-09-16	07-16-16	07-23-16	07-30-16	08-06-16	08-13-16

season	2016-2017												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-20-16	08-27-16	09-03-16	09-10-16	09-17-16	09-24-16	10-01-16	10-08-16	10-15-16	10-22-16	10-29-16	11-05-16	11-12-16
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-19-16	11-26-16	12-03-16	12-10-16	12-17-16	12-24-16	12-31-16	01-07-17	01-14-17	01-21-17	01-28-17	02-04-17	02-11-17
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-18-17	02-25-17	03-04-17	03-11-17	03-18-17	03-25-17	04-01-17	04-08-17	04-15-17	04-22-17	04-29-17	05-06-17	05-13-17
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-20-17	05-27-17	06-03-17	06-10-17	06-17-17	06-24-17	07-01-17	07-08-17	07-15-17	07-22-17	07-29-17	08-05-17	08-12-17

Table 12b: Week ending date corresponding to week number on Graphs 2, 11-15, 19-71 and 73, for each season

season	2017-2018												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-19-17	08-26-17	09-02-17	09-09-17	09-16-17	09-23-17	09-30-17	10-07-17	10-14-17	10-21-17	10-28-17	11-04-17	11-11-17
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-18-17	11-25-17	12-02-17	12-09-17	12-16-17	12-23-17	12-30-17	01-06-18	01-13-18	01-20-18	01-27-18	02-03-18	02-10-18
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-17-18	02-24-18	03-03-18	03-10-18	03-17-18	03-24-18	03-31-18	04-07-18	04-14-18	04-21-18	04-28-18	05-05-18	05-12-18
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-19-18	05-26-18	06-02-18	06-09-18	06-16-18	06-23-18	06-30-18	07-07-18	07-14-18	07-21-18	07-28-18	08-04-18	08-11-18

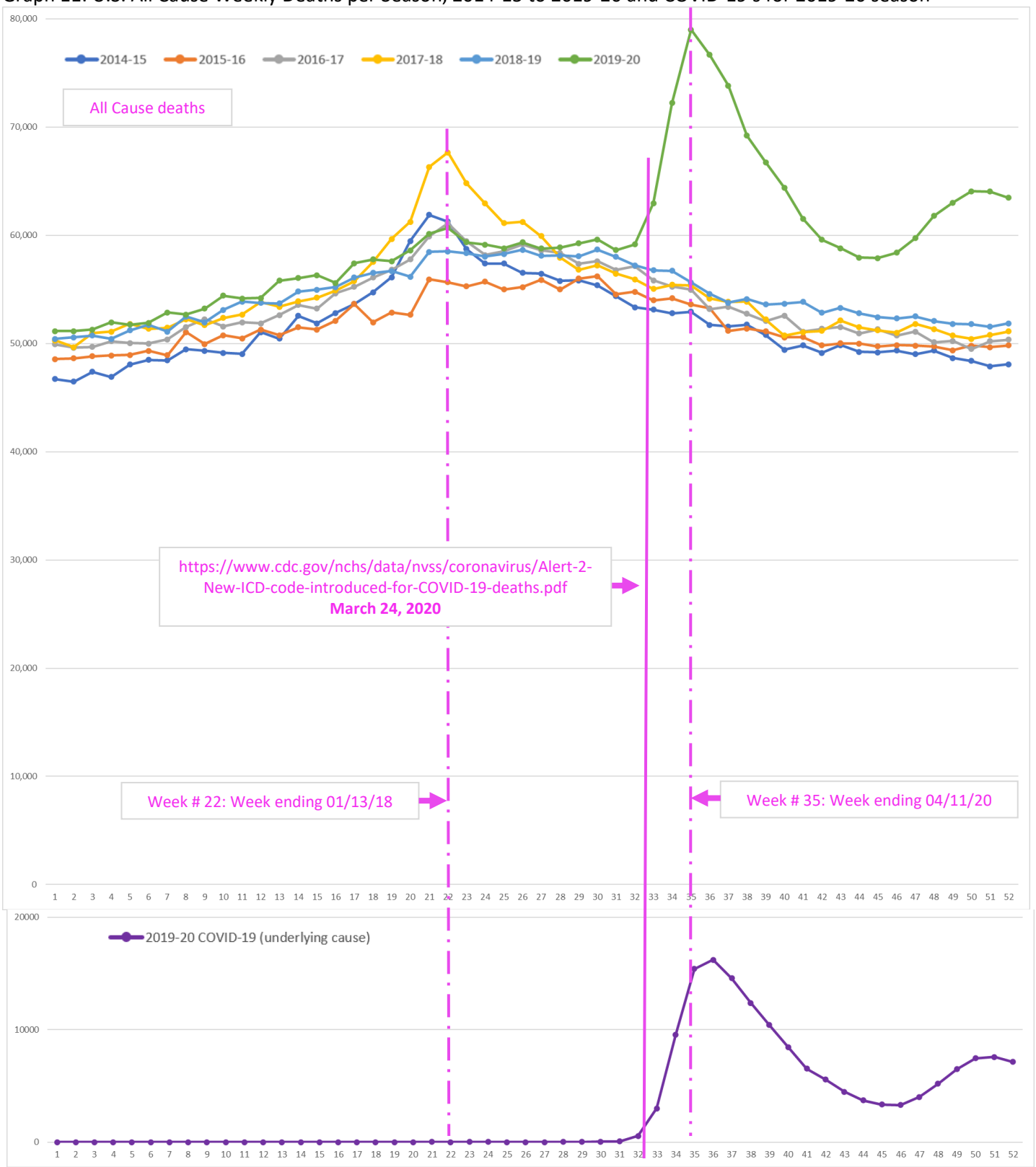
season	2018-2019												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-18-18	08-25-18	09-01-18	09-08-18	09-15-18	09-22-18	09-29-18	10-06-18	10-13-18	10-20-18	10-27-18	11-03-18	11-10-18
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-17-18	11-24-18	12-01-18	12-08-18	12-15-18	12-22-18	12-29-18	01-05-19	01-12-19	01-19-19	01-26-19	02-02-19	02-09-19
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-16-19	02-23-19	03-02-19	03-09-19	03-16-19	03-23-19	03-30-19	04-06-19	04-13-19	04-20-19	04-27-19	05-04-19	05-11-19
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-18-19	05-25-19	06-01-19	06-08-19	06-15-19	06-22-19	06-29-19	07-06-19	07-13-19	07-20-19	07-27-19	08-03-19	08-10-19

season	2019-2020												
Week #	1	2	3	4	5	6	7	8	9	10	11	12	13
ending date	08-17-19	08-24-19	08-31-19	09-07-19	09-14-19	09-21-19	09-28-19	10-05-19	10-12-19	10-19-19	10-26-19	11-02-19	11-09-19
Week #	14	15	16	17	18	19	20	21	22	23	24	25	26
ending date	11-16-19	11-23-19	11-30-19	12-07-19	12-14-19	12-21-19	12-28-19	01-04-20	01-11-20	01-18-20	01-25-20	02-01-20	02-08-20
Week #	27	28	29	30	31	32	33	34	35	36	37	38	39
ending date	02-15-20	02-22-20	02-29-20	03-07-20	03-14-20	03-21-20	03-28-20	04-04-20	04-11-20	04-18-20	04-25-20	05-02-20	05-09-20
Week #	40	41	42	43	44	45	46	47	48	49	50	51	52
ending date	05-16-20	05-23-20	05-30-20	06-06-20	06-13-20	06-20-20	06-27-20	07-04-20	07-11-20	07-18-20	07-25-20	08-01-20	08-08-20

Next, Graphs 11 through 15 are reviewed.

Graphs 11-15 are plots of weekly deaths per cause and per season, from season 2014-15 to season 2019-20. Because each of the seasons has a total of 52 weeks of reported deaths, Graphs 11-15's horizontal axes show weeks numbered 1 to 52. For a corresponding of week number (from 1 to 52) to the date the week ended, for each season, please see Tables 12a-12b.

Graph 11: U.S. All Cause Weekly Deaths per Season, 2014-15 to 2019-20 and COVID-19's for 2019-20 season



Graph 11

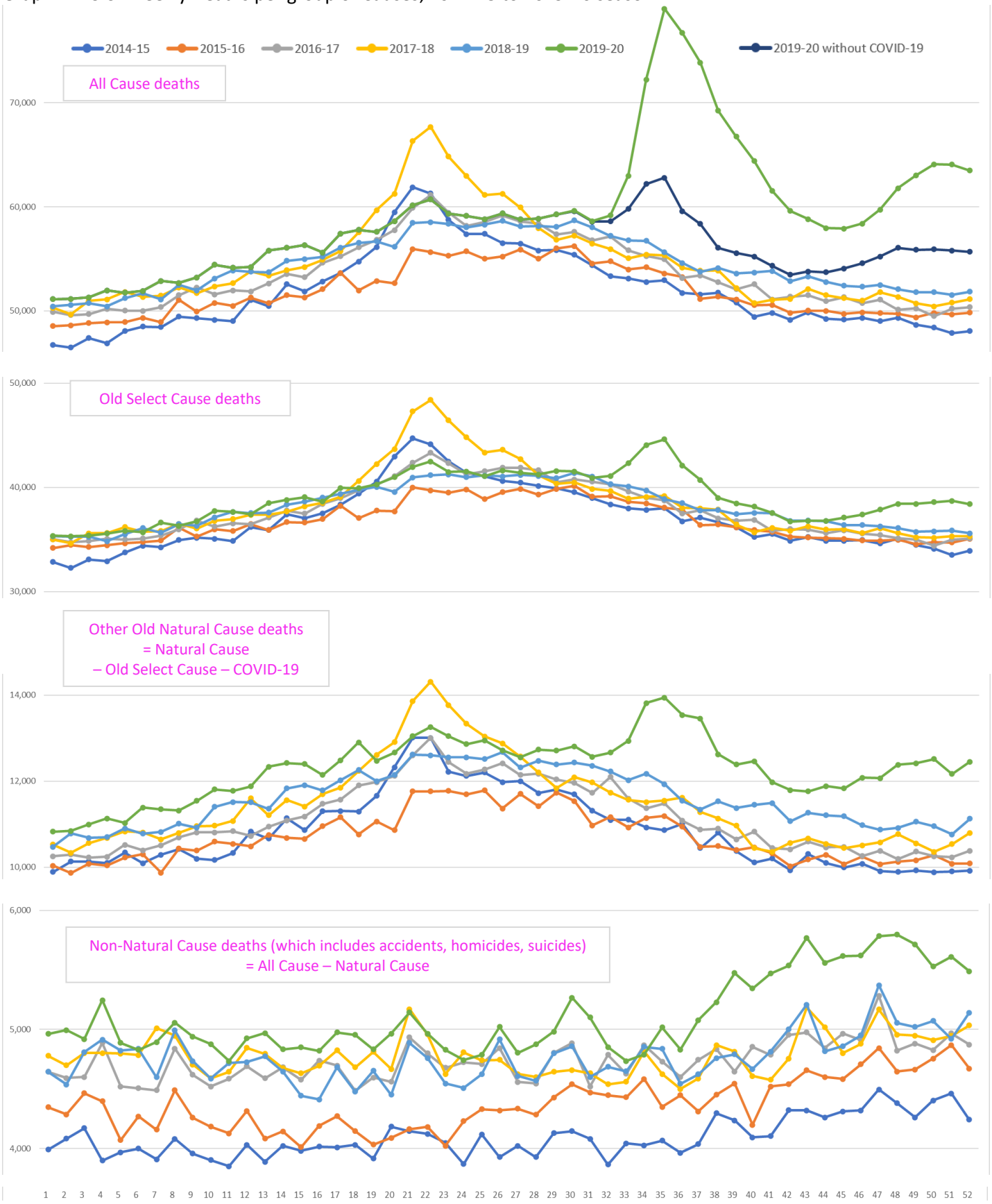
Graph 11 is the plot of the U.S. All Cause weekly deaths per season, from season 2014-15 to season 2019-20. The 2019-20 peak occurred week ending April 11th 2020 (in spring, which is unusual) while the 2018-20 occurred week ending January 13th 2018 (in winter, which is usual). What is most striking though is that the 2019-20 weekly deaths were following the pattern of deaths from previous years, very closely—until March 24.

Do you see that?—*very closely*, until March 24.

March 24, 2020 is the date a new code was introduced to record COVID-19 deaths (*15*). Prior to March 24, there was no category or cause of death code devoted to keeping track of deaths due to COVID-19. This was a new virus, so it makes sense there was no code for it, before. Still, other categories or causes of deaths due to respiratory diseases already existed: Chronic lower respiratory diseases, influenza and pneumonia, and other diseases of the respiratory system. The CDC performs a very important task, collecting health and death data. Although new codes and categories need to be introduced, they can make the interpretation of the data collected more difficult—especially if the use of a new code or category of death is heavily incentivized. The departure from the historical pattern of deaths, after March 24, 2020 is so abrupt though, there has to be other explanations!

Doesn't it?

Graph 12: U.S. Weekly Deaths per group of Causes, 2014-15 to 2019-20 season

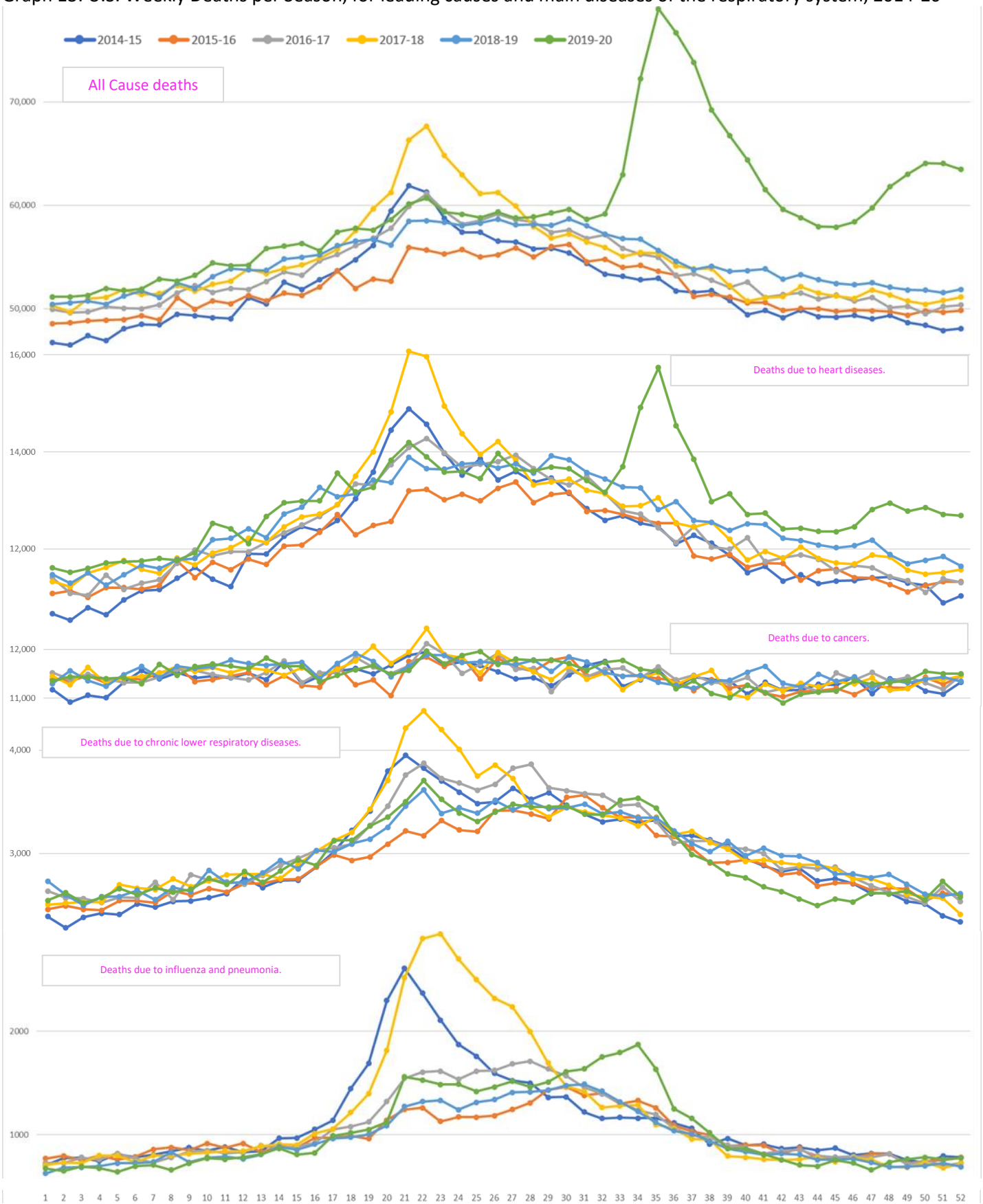


Graph 12

To Graph 12, a 2019-20 without COVID-19 series, is added to the All Cause deaths graph. Below that, are the following plots: Old Select Cause deaths, Other Old Natural Cause deaths and Non-Natural Cause deaths. Old Select Cause deaths follow the exact same patterns as the All Cause deaths, without COVID-19. Old Select Cause are the main natural causes of death, and together they have consistently accounted for 70-71% of All Cause deaths, so it makes sense that their deaths would drive the pattern of All Cause deaths. The Other Old Natural Cause deaths seem to be showing a higher level of deaths than expected, for the second part of 2019-20 season (compared to the first part of the season). Non-Natural Cause deaths seem to be growing over the years, with an end of the season's level higher than the level of deaths experienced at the beginning of the season, season after season—but that increase seems to be higher for the 2019-20 season.

The increase in Non-Natural Cause deaths over the years would be consistent with Roosen et al.'s remark about "increasing trends in certain causes such as drug overdose mortality" (*5*). Would the higher increase of Non-Natural Cause deaths in 2019-20 give support to the assessment that the cure has been worse than the virus? Or only point to the increased number of deaths experienced year after year? Those are questions that will need to be answered.

Graph 13: U.S. Weekly Deaths per Season, for leading causes and main diseases of the respiratory system, 2014-20



Graph 13

Each of Graph 13 through Graph 15 first displays a copy of Graph 11 so the synchronicity of All Cause deaths peak and other select causes deaths peaks, over the years, can more easily be identified. Below that, are plots of deaths due to select causes from season 2014-15 to season 2019-20.

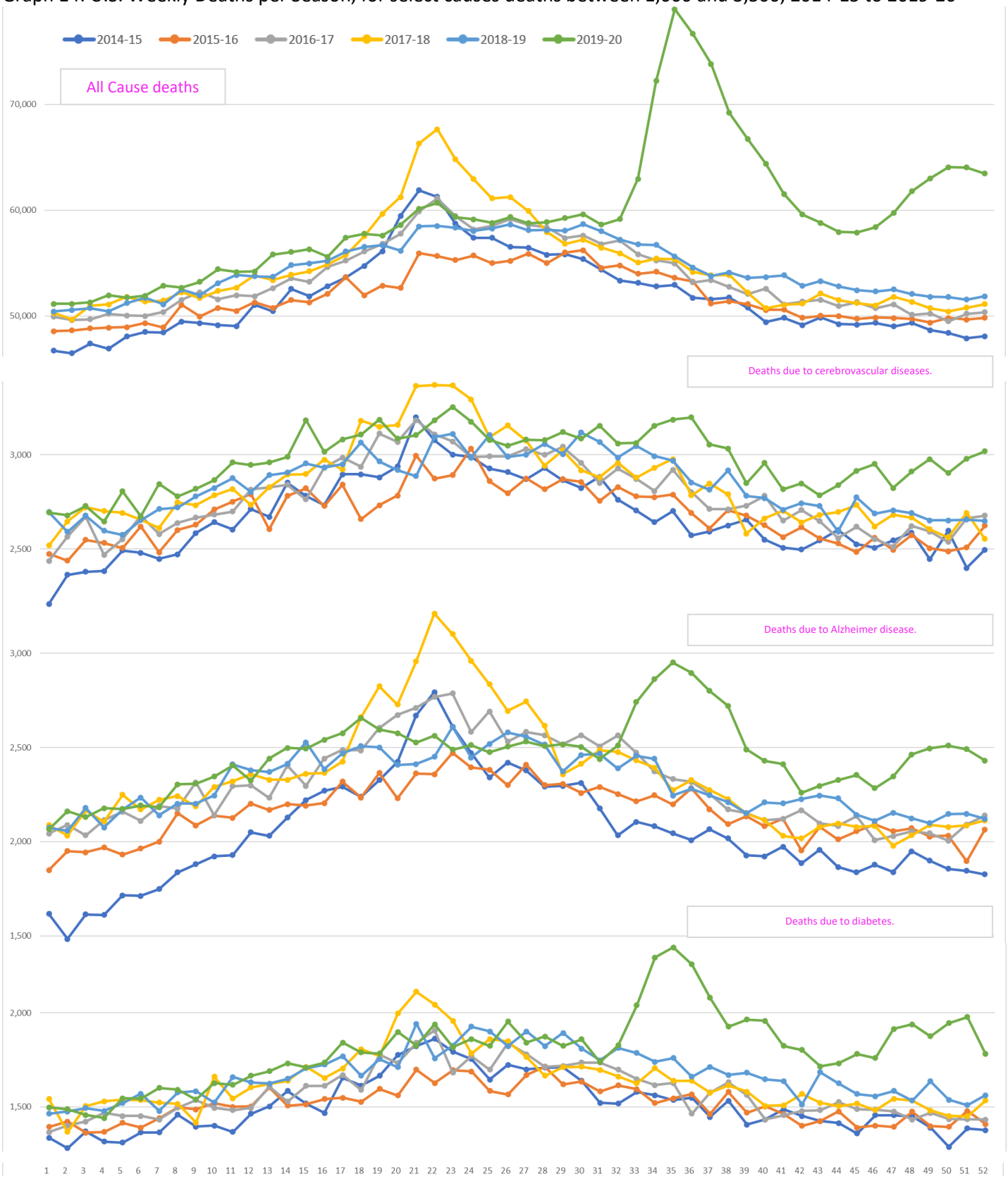
Graph 13 shows that the 2020 peak of deaths due to heart diseases is lower than its 2018's peak, even though heart diseases are the leading cause of deaths in the U.S. and heart diseases deaths peaks have followed the All Cause deaths peaks pattern in the past (highs/lows and relatively magnitude across years). In other words, a continuation of historical patterns would have dictated a higher peak of heart diseases deaths in 2020 than its 2018 peak. Now, the 2020 All Cause deaths peak occurred "off season"—but so does the heart diseases one—and at exactly the same week (week ending April 11, 2020). Why? Note, after that "off-season" 2020 peak, the level of deaths due to heart diseases does not go back down to its pre-March 24, 2020 level. Why?

Although a seasonality of deaths due to cancers was observed on Graph 5, it was not as pronounced as other causes of death. This is also seen here, middle section of Graph 13. In addition, Graph 13 shows no noticeable change in the pattern of deaths due to cancers, from previous seasons.

Below cancers, on Graph 13, deaths due to chronic lower respiratory diseases, not only, do not show a 2020 peak at all, but reach levels lower than they ever had before, come late spring. Because both COVID-19 and chronic lower respiratory diseases are respiratory diseases, this would be evidence that some re-classification between the two causes of deaths might have occurred.

Deaths due to influenza and pneumonia (last cause of death on Graph 13), like deaths due to heart diseases, also display an "off-season" peak for 2019-20, which is much lower than its previous two peaks, and which is synchronous with All Cause peak (and thus COVID-19's). Unlike deaths due to heart diseases, after their peak, the deaths due to chronic lower respiratory diseases go back to their previous seasons' levels. Because COVID-19, influenza and pneumonia are all respiratory diseases, and because historical patterns would have dictated a higher peak of deaths due to influenza and pneumonia in 2020 than its 2018 peak, would this be evidence that some re-classification between the two causes of deaths might have occurred?

Graph 14: U.S. Weekly Deaths per Season, for select causes deaths between 1,000 and 3,500; 2014-15 to 2019-20



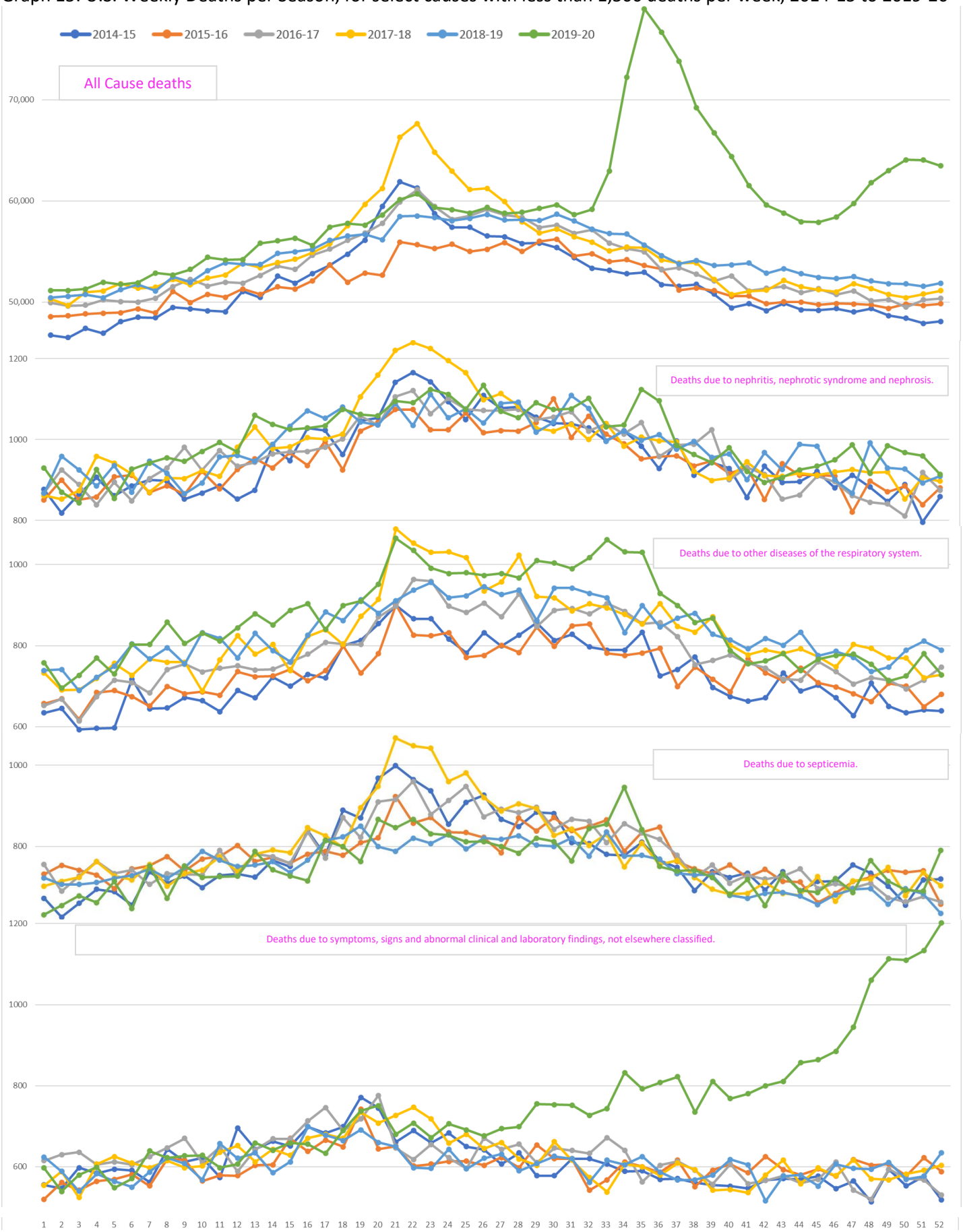
Graph 14

Graph 14 reveals that during the 2020 deaths peak, deaths due to cerebrovascular diseases and Alzheimer disease nearly reached their previously highest peak level, season 2017-18, while deaths due to diabetes well surpassed it. Again, all those 2020 "off-season" peaks occurred over the same weeks. Note, after their "off-season" 2020 peak, the levels of deaths due to those select causes do not go back down to their pre-March 24, 2020 level. Historical patterns would have dictated a higher peak of deaths due to cerebrovascular diseases and Alzheimer's in 2020 than their 2018 peak. Could this also be evidence of some re-classification between those causes of deaths and COVID-19? Historical patterns would also have dictated a more decisive return to lower level of deaths consistent with historical seasonal levels. Finally, why does the level of deaths due to diabetes seem to be higher than historical patterns suggest it should have been?

Now is a good time to remember that the All Cause deaths level for 2019-20 is not unexpected nor alarming: See earlier section about U.S. deaths put into its short-term historic context. Nonetheless, the changes in the patterns of deaths are worth inquiring about.

One more thing to note on Graph 14, is about Alzheimer deaths—2014-15 season. For the first part of this 2014-15 season, Alzheimer deaths are distinctively lower than other seasons. This was also visible on Graph 8, where the earlier trough is much lower than later ones (see the Alzheimer series at the bottom of Graph 8). Starting in 2015, the number of Alzheimer deaths is distinctively higher. Could this be due to the adoption of new means (improved tests/methodology) that allowed better detection of Alzheimer at the time? This is very important to note: An increased deaths number due to a specific cause is not necessarily solely due to the disease being more prevalent but can also be due to the availability of new methodology and increased means devoted to its detection and recording, as well as incentives to do both. Could the sharp increase in U.S. COVID-19 deaths numbers, be partly explained by the corresponding sharp increase, in financial means and manpower, devoted to developing and implementing methodology to detect them, and to recording them? As well as the pressure to do so?

Graph 15: U.S. Weekly Deaths per Season, for select causes with less than 1,500 deaths per week, 2014-15 to 2019-20



Graph 15

Graph 15 reveals small and short lived “off-season” peaks of deaths due to nephritis, nephrotic syndrome and nephrosis, as well as due to septicemia. After their peaks, those deaths go back to their previous seasons’ levels. Their 2020 peaks did not reach their 2018 peaks though, which, again, is unexpected given historical trends.

Deaths due to other diseases of the respiratory system (also on Graph 15) reached an “off-season” peak on par with their 2018’s one. After their peak, those deaths go back to their previous seasons’ levels—although at a lower level than its pre-March 24, 2020 level (not as noticeable as it was for deaths due to influenza and pneumonia on Graph 13). Because COVID-19 and other diseases of the respiratory system are all respiratory diseases, and because historical patterns would have dictated a higher peak of deaths due to other diseases of the respiratory system in 2020 than its 2018 peak, would this be evidence that some re-classification between the two causes of death might have occurred?

The last plot on Graph 15 is that of deaths due to symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified. The 2019-20 line distinctively departs from usual patterns in the second half of the season. (This was visible on Graph 10, as well.) If a new COVID-19 category had not been implemented, this could have been interpreted as deaths due to unfamiliar and/or not elsewhere classifiable COVID-19 symptoms—this cannot be the case since we have had a new code for COVID-19 deaths since March 24, 2020.

Dr. Rossen explains that many of these still provisional deaths due to symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified, will go on to be coded as external causes of death. External causes of death include accidents, assault (homicides), intentional self-harm (suicides) and injuries of undetermined intent (*21*). Some will also be updated to various natural causes as well (*4*).

Could those deaths due to symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified, reflect the unprecedented state of stress, anxiety, anger, depression, and incomprehension, that the COVID-19 campaigns of fear and isolation has brought on individuals who usually find health, meaning, and thrive, through positive interactions with others?

In the last section, the variability of weekly deaths across jurisdictions is explored.

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6 Weekly deaths per jurisdiction: Variability

Graph 16: All Cause Deaths per Week and U.S. Jurisdiction, from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020. Vertical axis scaled with minimum bound of 0 and maximum bound of 8,000 on all plots.

Graph 16 displays the plots of All Cause deaths per week—for all U.S. jurisdictions, over the period from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020, a total of 358 weeks. For additional ease of comparison between jurisdictions, all plots used the same scale on their vertical axes, with a minimum bound of 0 and a maximum bound of 8,000 deaths. The drawback from this graph's format is that the seasonality of deaths cannot be discerned as well as it could on Graph 4, especially for lower deaths numbers' jurisdictions. Nonetheless, Graph 16 gives a great overview of the variability of deaths across jurisdictions.

Where is Waldo? is usually a game of finding a needle in a hay stack—but, in this case, the 2020 deaths peak anomaly clearly stands out. Which jurisdiction would that be? You are invited to consult Table 14, which gives the jurisdictions' names corresponding to the plots displayed on Graph 16, to find out.

Where are the most populated jurisdictions?

Do all jurisdictions show a 2020 deaths peak?

Do all jurisdictions show a seasonality of deaths?

How many jurisdictions show an alarmingly high 2020 deaths peak?

How many jurisdictions do not show any 2020 deaths peak at all?

Graphs 17-69 (see Appendix) are individual plots of All Cause weekly deaths per season, from season 2014-15 to season 2019-20, for each U.S. jurisdiction. Jurisdictions include the 50 U.S. states, plus District of Columbia, New York City and Puerto Rico territory. The graphs are presented in alphabetic order of the U.S. jurisdictions' names. Readers are encouraged to consult the graph for their jurisdiction of residence or any jurisdiction(s) of special interest to them. Graphs 17-69 take a closer look at the variability first outlined by Graph 16.

Did you find the anomaly on Graph 16? Or maybe a couple of them?

Were the numbers of COVID-19 weekly deaths, ever, at a disturbingly high level, for jurisdictions other than New York City and the State of New Jersey? Would the variability of weekly deaths and 2020 peaks, observed across states within the United States, also be observed across counties within each state? This is something that every state and every county would need to investigate, if they have not done so already.

Table 14: U.S. Jurisdictions corresponding to Plots in Graph 16.

Alabama	Alaska	Arizona	Arkansas	California	Colorado	Connecticut	Delaware
District of Columbia	Florida	Georgia	Hawaii	Idaho	Illinois	Indiana	Iowa
Kansas	Kentucky	Louisiana	Maine	Maryland	Massachusetts	Michigan	Minnesota
Mississippi	Missouri	Montana	Nebraska	Nevada	New Hampshire	New Jersey	New Mexico
New York	New York City	North Carolina	North Dakota	Ohio	Oklahoma	Oregon	Pennsylvania
Puerto Rico	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah	Vermont
Virginia	Washington	West Virginia	Wisconsin	Wyoming			

Table 15: Weekly deaths per jurisdiction, week ending 01/11/14-03/21/20 and 04/11/20-04/25/20 periods

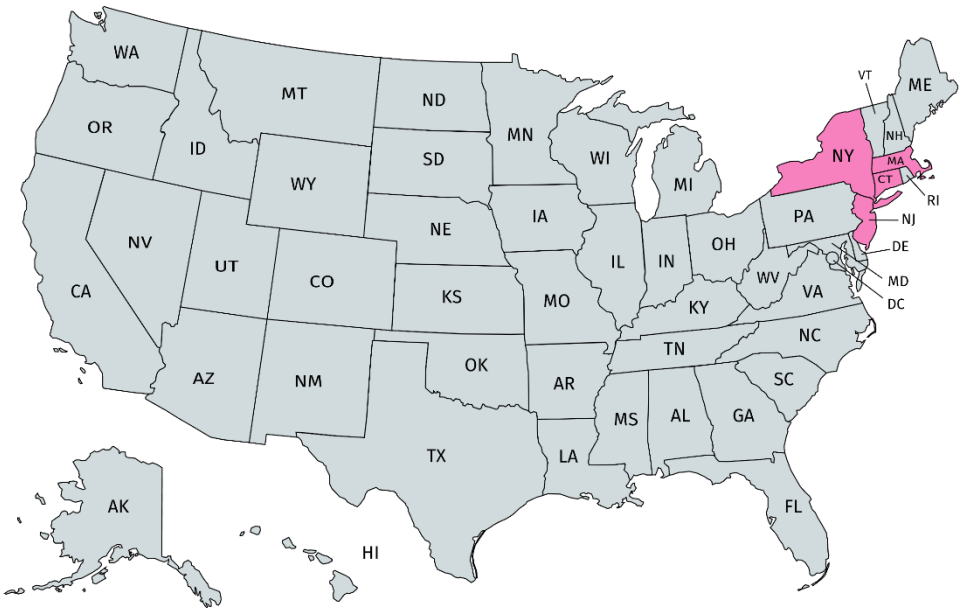
Pre-March 24, 2020: Week ending 01/11/14-03/21/20		3-week peak deaths 2019-20: Week ending 04/11/20-04/25/20	
United States	53,275	United States	76,505
California	5,073	California	6,037
Florida	3,871	New York City	5,936
Texas	3,805	Florida	4,505
Pennsylvania	2,583	New Jersey	4,491
Ohio	2,311	Texas	4,339
Illinois	2,019	New York	4,289
New York	1,900	Pennsylvania	3,671
Michigan	1,836	Michigan	3,112
North Carolina	1,775	Illinois	2,930
Georgia	1,590	Ohio	2,705
New Jersey	1,398	Massachusetts	2,354
Tennessee	1,394	North Carolina	2,049
Virginia	1,280	Georgia	2,031
Indiana	1,244	Virginia	1,617
Missouri	1,214	Indiana	1,577
Massachusetts	1,124	Tennessee	1,512
Arizona	1,107	Missouri	1,418
Washington	1,069	Maryland	1,416
New York City	1,043	Louisiana	1,376
Alabama	982	Arizona	1,368
Wisconsin	968	Connecticut	1,324
Maryland	935	Washington	1,262
South Carolina	919	Alabama	1,138
Kentucky	909	Colorado	1,089
Louisiana	868	South Carolina	1,070
Minnesota	837	Wisconsin	1,015
Oklahoma	746	Kentucky	986
Colorado	735	Minnesota	965
Oregon	693	Oklahoma	810
Arkansas	602	Oregon	768
Mississippi	599	Mississippi	727
Connecticut	596	Arkansas	629
Iowa	573	Iowa	605
Puerto Rico	570	Puerto Rico	568
Kansas	499	Nevada	566
Nevada	477	Kansas	537
West Virginia	430	West Virginia	436
Utah	355	New Mexico	408
New Mexico	344	Utah	391
Nebraska	324	Nebraska	350
Maine	275	Maine	300
Idaho	260	Idaho	284
New Hampshire	231	Rhode Island	272
Hawaii	218	New Hampshire	262
Rhode Island	198	Delaware	244
Montana	192	District of Columbia	212
Delaware	172	Hawaii	211
South Dakota	154	Montana	198
North Dakota	135	South Dakota	159
District of Columbia	115	North Dakota	158
Vermont	110	Vermont	125
Wyoming	86	Wyoming	96
Alaska	82	Alaska	75

Prior to March 24, 2020, the U.S. jurisdictions with the highest average weekly deaths were California, Florida and Texas (see Table 15). That makes sense. These correspond to the three most highly populated US jurisdictions and the higher the population, the higher the weekly deaths. Deaths, after all, are part of life. Similarly, some of the least populated U.S. jurisdictions experience the lowest average weekly deaths numbers. Those are Vermont, Wyoming and Alaska.

From week ending April 11, 2020 to week ending April 25, 2020, the three weeks with the highest weekly deaths in season 2019-20, the states of California, Florida and Texas kept their ranking relative to one another. However, New York City and the State of New Jersey became 2nd and 4th, respectively, in the ranking of U.S. jurisdictions for average weekly deaths, while they ranked 19th and 11th, respectively, prior to March 24th 2020. What happened?

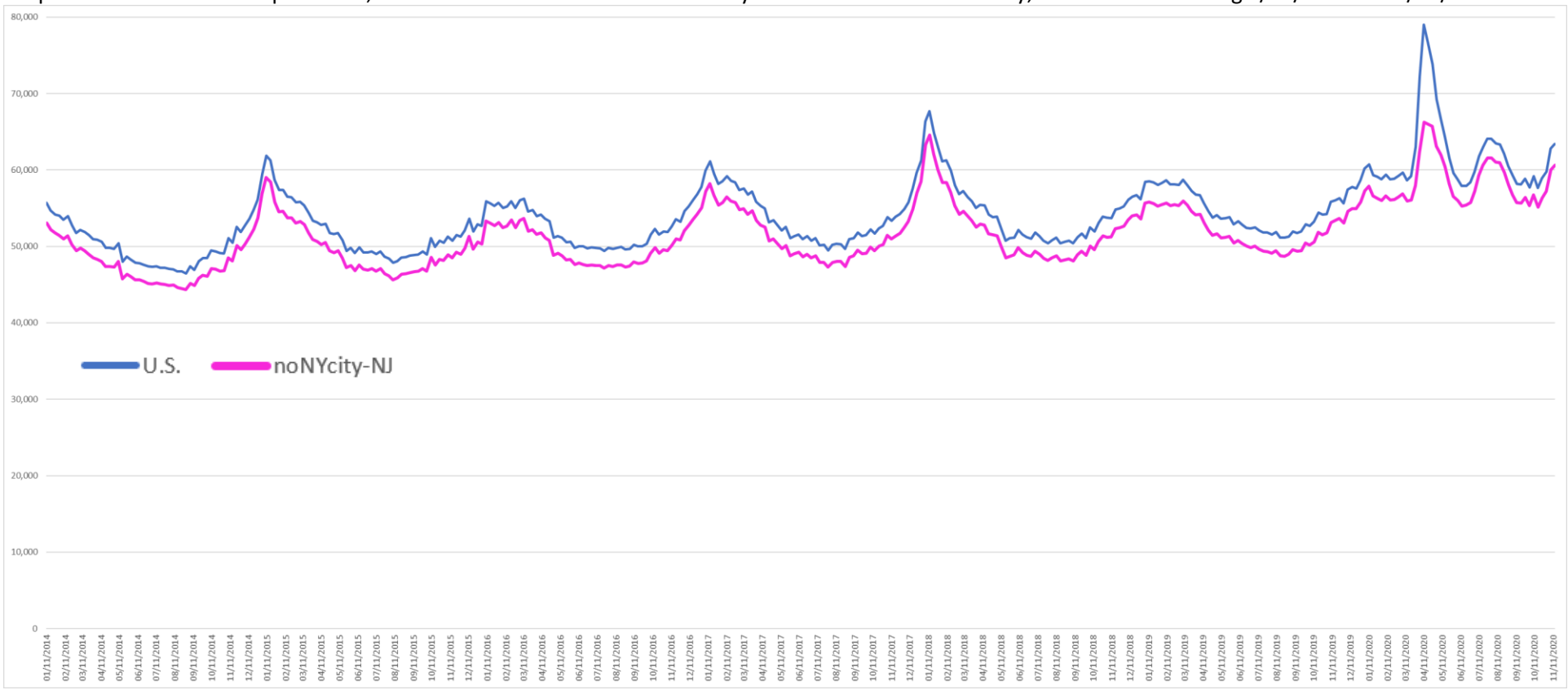
New York City's average weekly deaths increased from 1,043, pre-March 24 2020, to an average of 5,936 dead per week, from week ending April 11 to April 25, 2020. That is a 469% increase! How is that even possible? Does this imply that deaths were shifted across weeks (as in, accelerated in time) for New York City? Those are questions New York City and families of the deceased will have to grapple with.

The five jurisdictions that experienced a percentage change in average weekly deaths greater than 100%, from the pre-March 24 2020 period to the three-week peak deaths period from week ending 4/11/20 to 4/25/20, are:

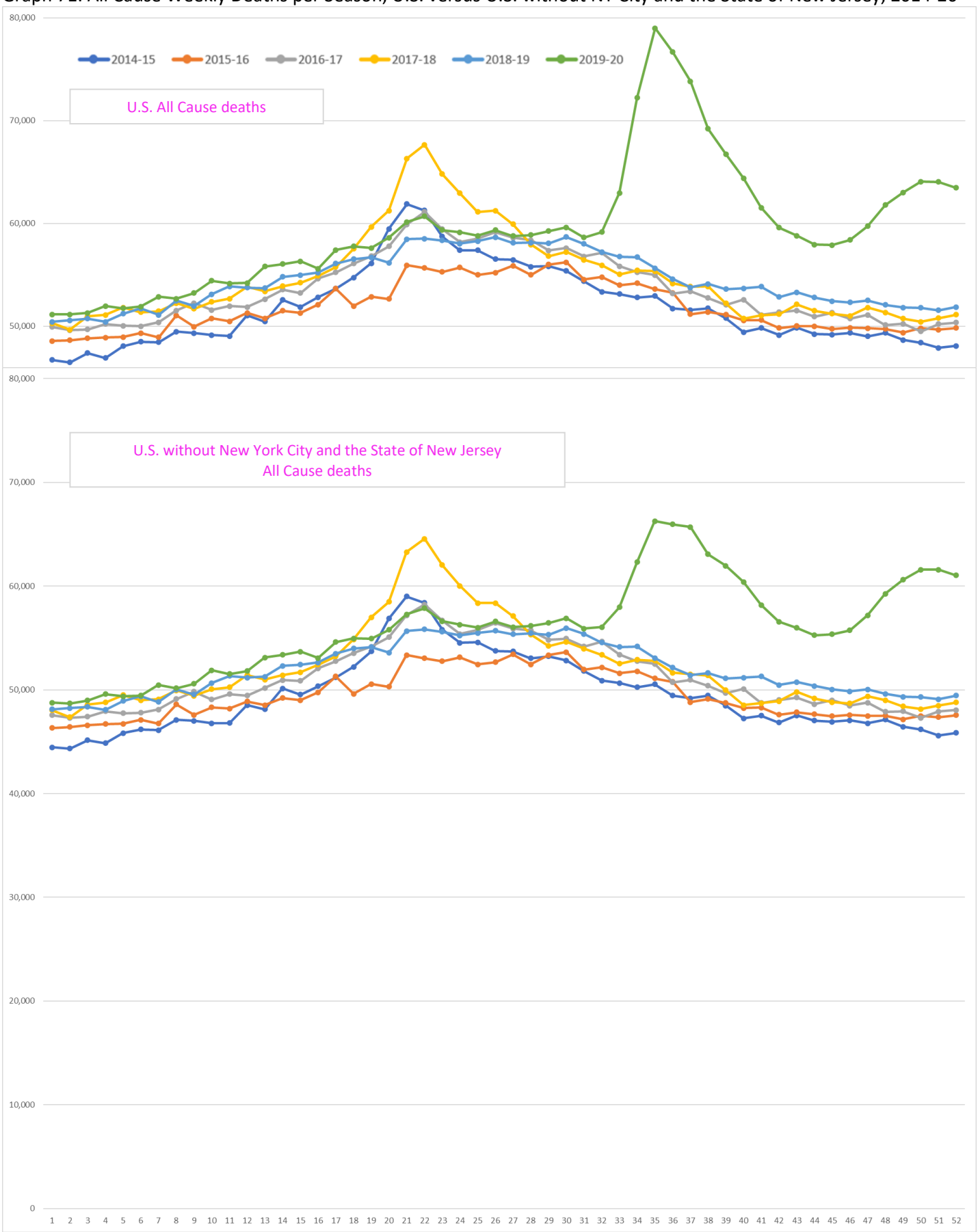


- New York City: 469%
- New Jersey: 221%
- New York: 126%
- Connecticut: 122%
- Massachusetts:110%

Graph 70: All Cause Deaths per Week, U.S. versus U.S. without New York City and the State of New Jersey, MMWR week ending 1/11/2014 to 11/14/2020



Graph 71: All Cause Weekly Deaths per Season, U.S. versus U.S. without NY City and the State of New Jersey, 2014-20



Graph 70 displays All Cause weekly deaths, from MMWR week ending 1/11/2014 to MMWR week ending 11/14/2020, a total of 358 weeks, for the U.S. as a whole (like Graph 4 did), and for all U.S. jurisdictions, except New York City and the State of New Jersey.

Graph 71 displays All Cause weekly deaths per season, from 2014-15 to 2019-20, for the U.S. as a whole (like Graph 11 did), and for all U.S. jurisdictions, except New York City and the State of New Jersey.

Graphs 70 and 71 reveals that New York City and the State of New Jersey's numbers sorely skewed the picture of the U.S. COVID-19 situation. Did this, in turn, drive the states and counties health officers' decisions, all across the United States? Or did health officers diligently analyze the situation at their own state or county level? Those are questions that residents across states and counties would surely want to be answered.

7 Conclusion

The CDC data on U.S. deaths used in this analysis are the best available data at one point in time. Each and every recorded death is given one and only one underlying cause of death. Old age is not an underlying cause of death. U.S. total deaths' increases over the years have followed U.S. population's increases. U.S. total deaths for calendar year 2020 or season 2019-20 are normal death numbers, as shown by death rate statistics. Death rate statistics account for the increase in population over the years—standard "excess deaths estimates" do not.

The U.S. age distribution of deaths did not significantly change following COVID-19. This suggests the reason a higher number of COVID-19 deaths has been reported among older individuals than younger individuals, is simply because, every day in the U.S., COVID-19 or not, those aged 85 or older are at a higher risk of dying than those aged 84 or younger. This should come as no surprise to anyone.

Deaths have followed a pattern of highs and lows, year after year, and the magnitude of those highs and lows, one year relatively to another, has been consistent for each and every main cause of death. In other words, the peaks of deaths, from all those different causes, have coincide (happened over the same weeks)—year after year, and the magnitude of those peaks for one year relative to another, for each cause, has also been consistent across causes. But not for 2020.

Respiratory diseases had previously been classified into one the following three cause of death categories: Chronic lower respiratory diseases, influenza and pneumonia, and other diseases of the respiratory system. The historically low levels of deaths due to these old respiratory diseases points to a reclassification of deaths into the newly and specially introduced respiratory disease category for COVID-19. Level of deaths departing from their historical levels, such as deaths due to non-natural causes (suicides) and natural cause (diabetes) points to mitigation efforts (isolation, lockdowns) being the cause of death, rather than COVID-19 itself.

March 24th 2020 is the date the new International Classification of Diseases (ICD) code issued by the World Trade Organization (WHO) for COVID-19 was introduced and implemented in the United States. Up until then, the CDC's deaths data provided a treasure trove of information, with easily recognizable seasonal patterns and the U.S. weekly deaths were following those historical patterns, *exactly*. On week ending March 28th 2020, the U.S. weekly deaths *sharply* departed from them. Are the unfamiliar patterns seen since due to COVID-19 or the reoccurring fear campaigns?

On March 13, 2020 the President of the United States declared a national emergency concerning COVID-19 that would legally allow the distribution of funds. The unprecedented level of efforts, pressure, and means devoted to COVID-19 since, rule out any concerns of underreporting of COVID-19 deaths. What role have those different incentives play in the potential overreporting of COVID-19 deaths?

The picture of the U.S. COVID-19 situation was heavily skewed by deaths numbers from jurisdictions such as New York City and the State of New Jersey. At the state level, many have shown no change in deaths numbers and pattern of deaths in 2019-20, compared to prior seasons.

Has any consideration ever been given to the relevance of the national picture and national “solutions”, to state, county, local and individual situations? Or have COVID-19 measures been blindly adopted and applied, top-down, in haste, obsessively and short sightedly? What role did groupthink play into this? Those questions will need to be answered.

A more holistic approach to health seems to be needed to address each individual’s unique circumstances, needs and preferences. Only such an approach can minimize all the suffering and inequities at the individual level, and maximize welfare at the society level. This individual centered approach to health needs not to harm one, for others to benefit. It fosters unity, by being compassionate to all.

8 Testimonials

9 References

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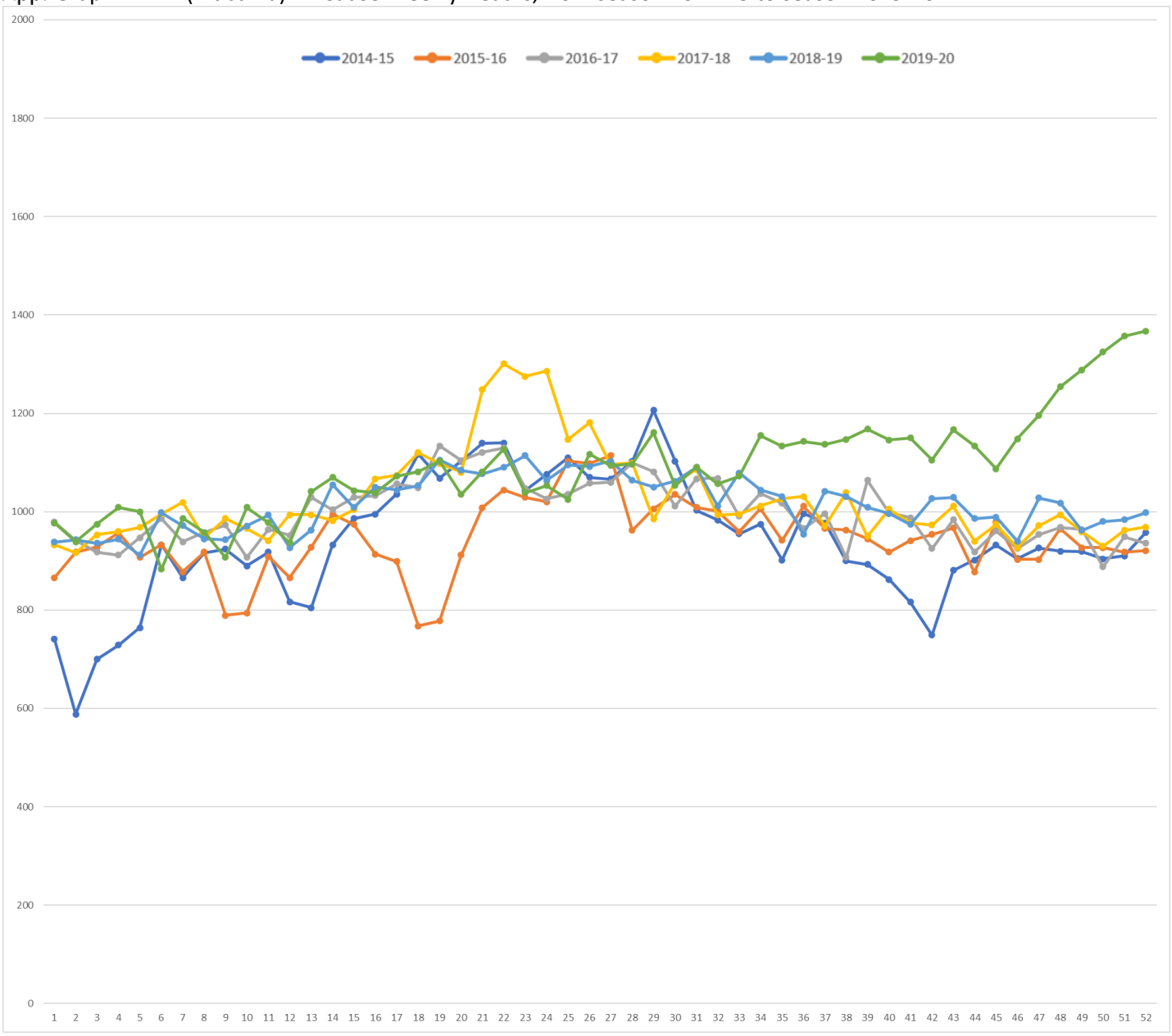
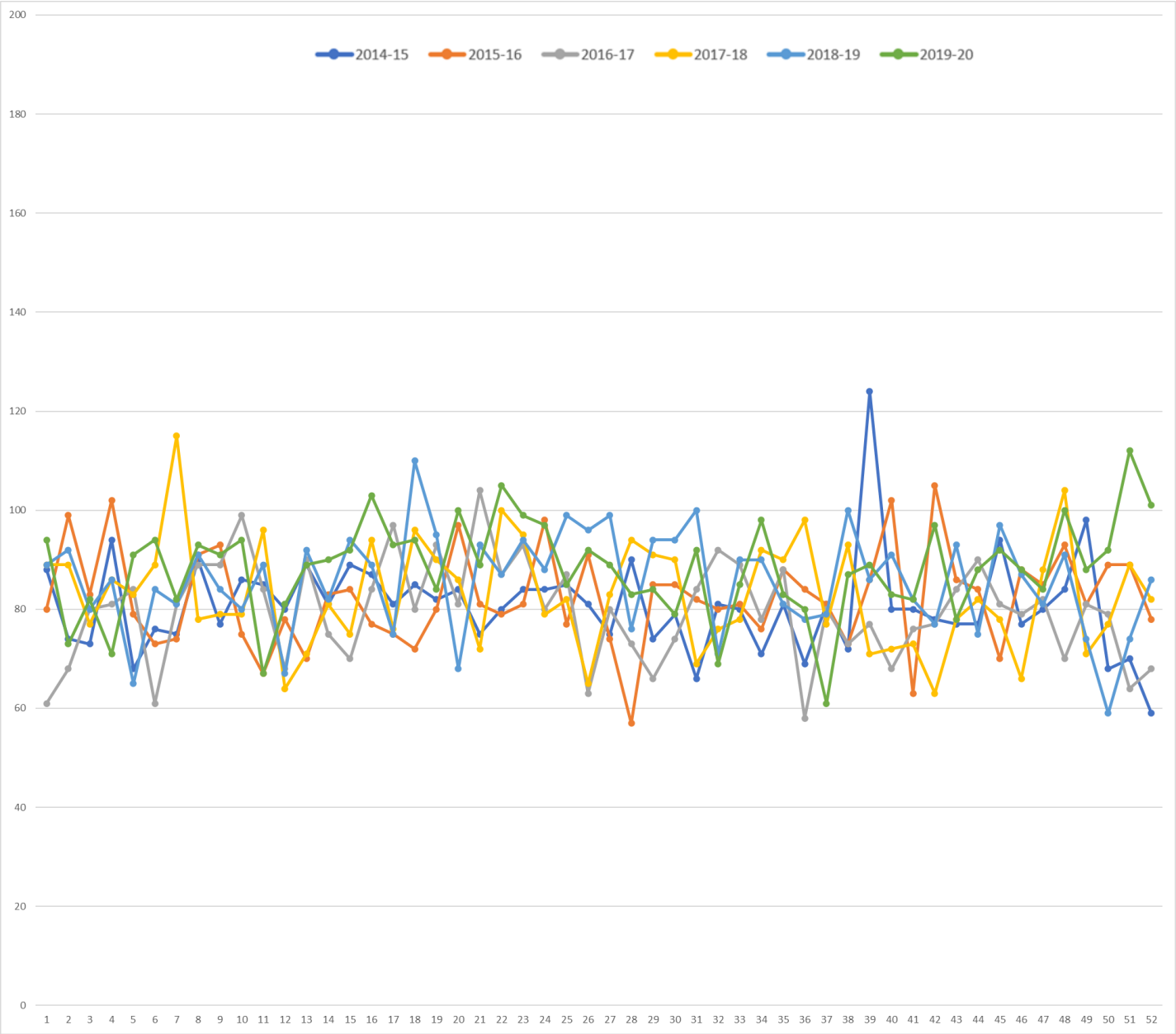
10 Appendix

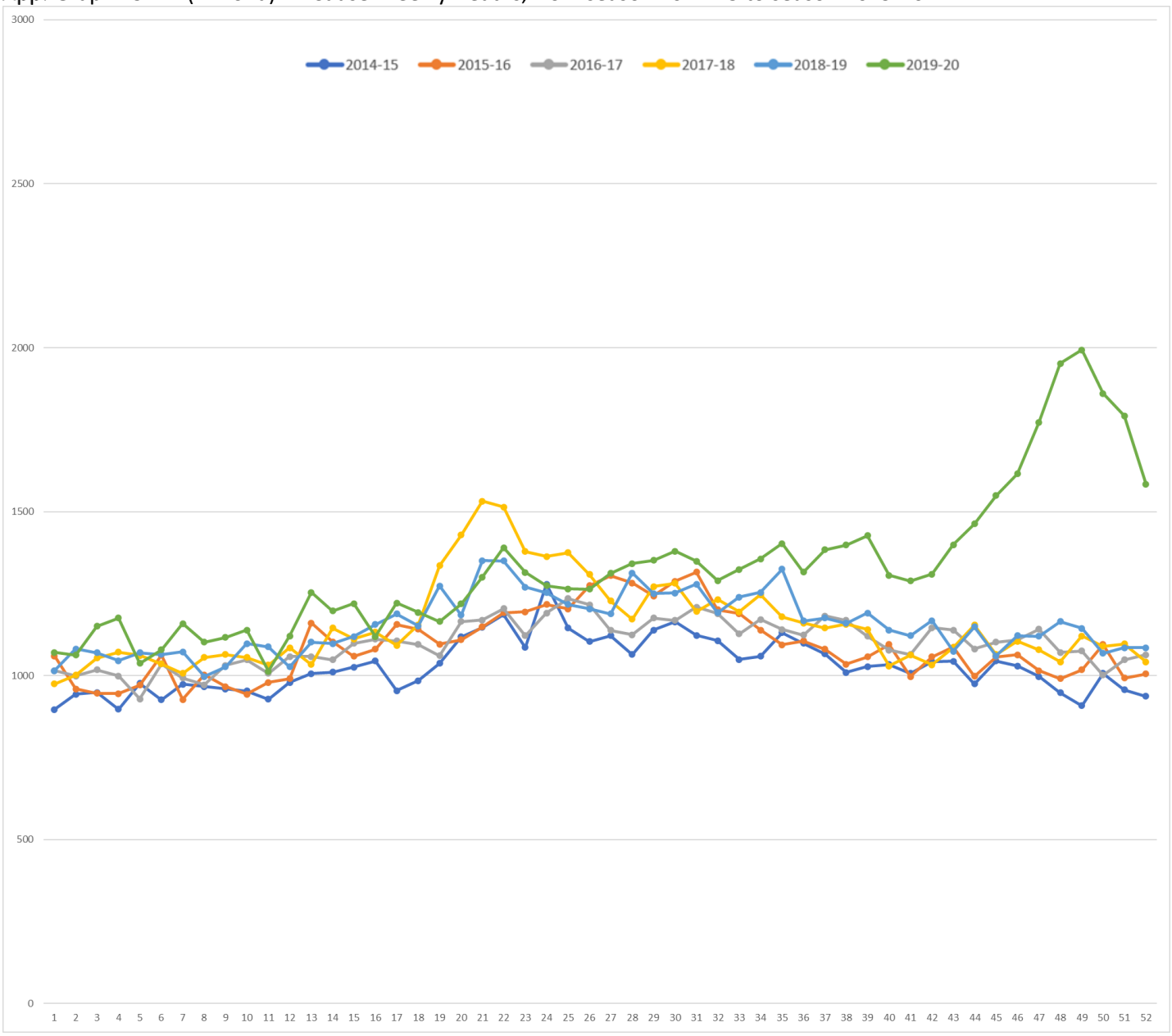
App. Graph 17: AL (Alabama) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



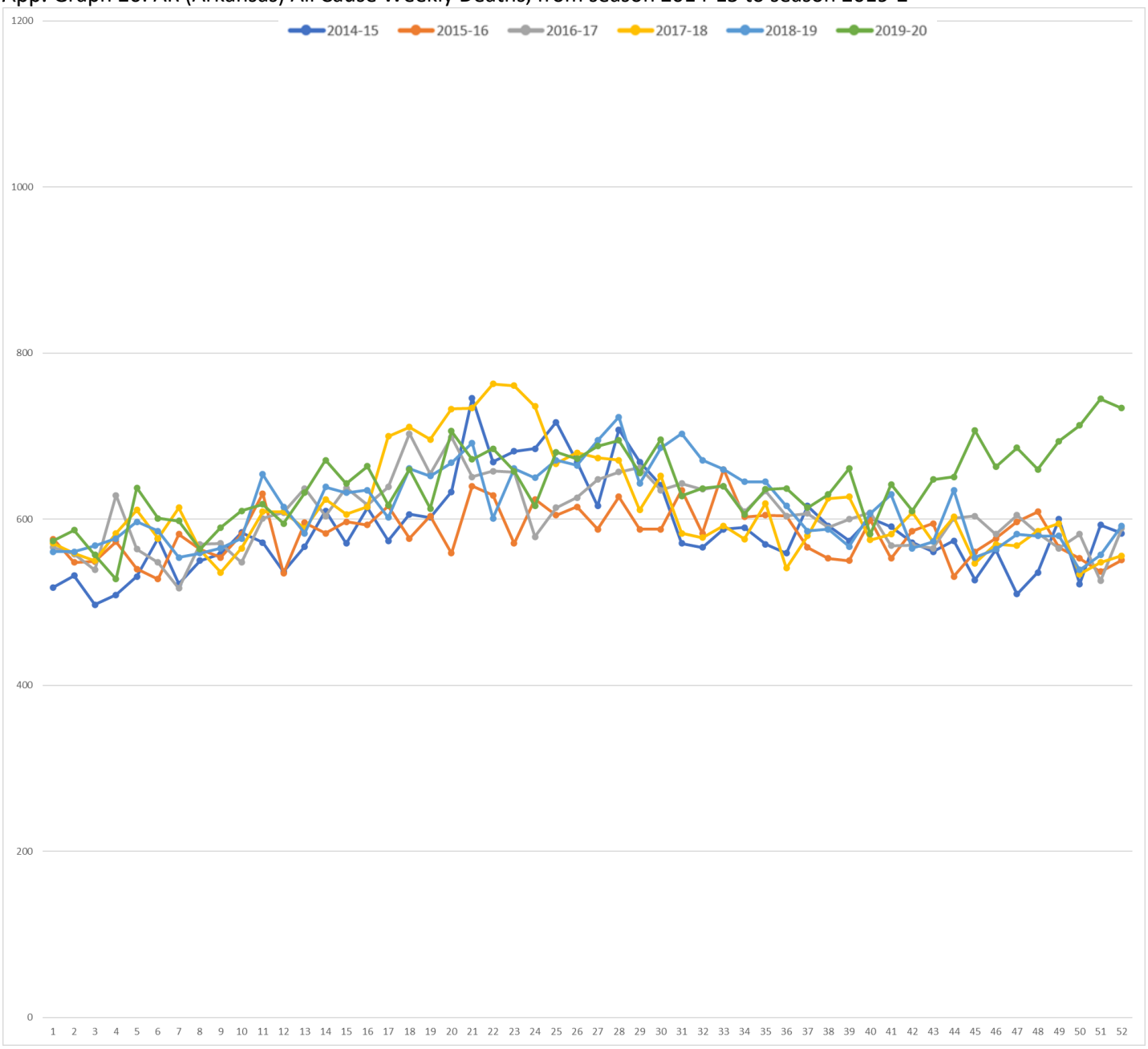
App. Graph 18: AK (Alaska) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



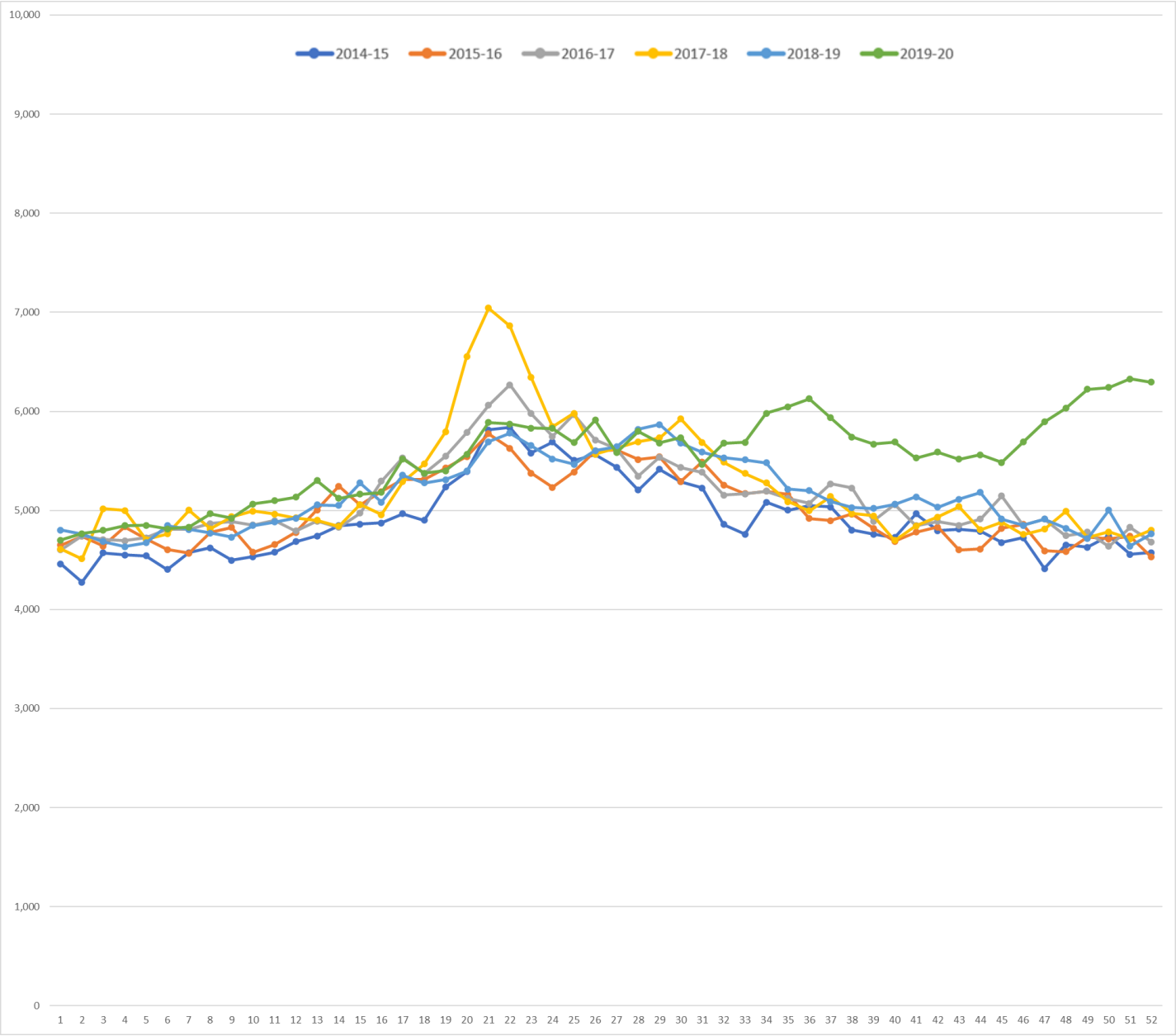
App. Graph 19: AZ (Arizona) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



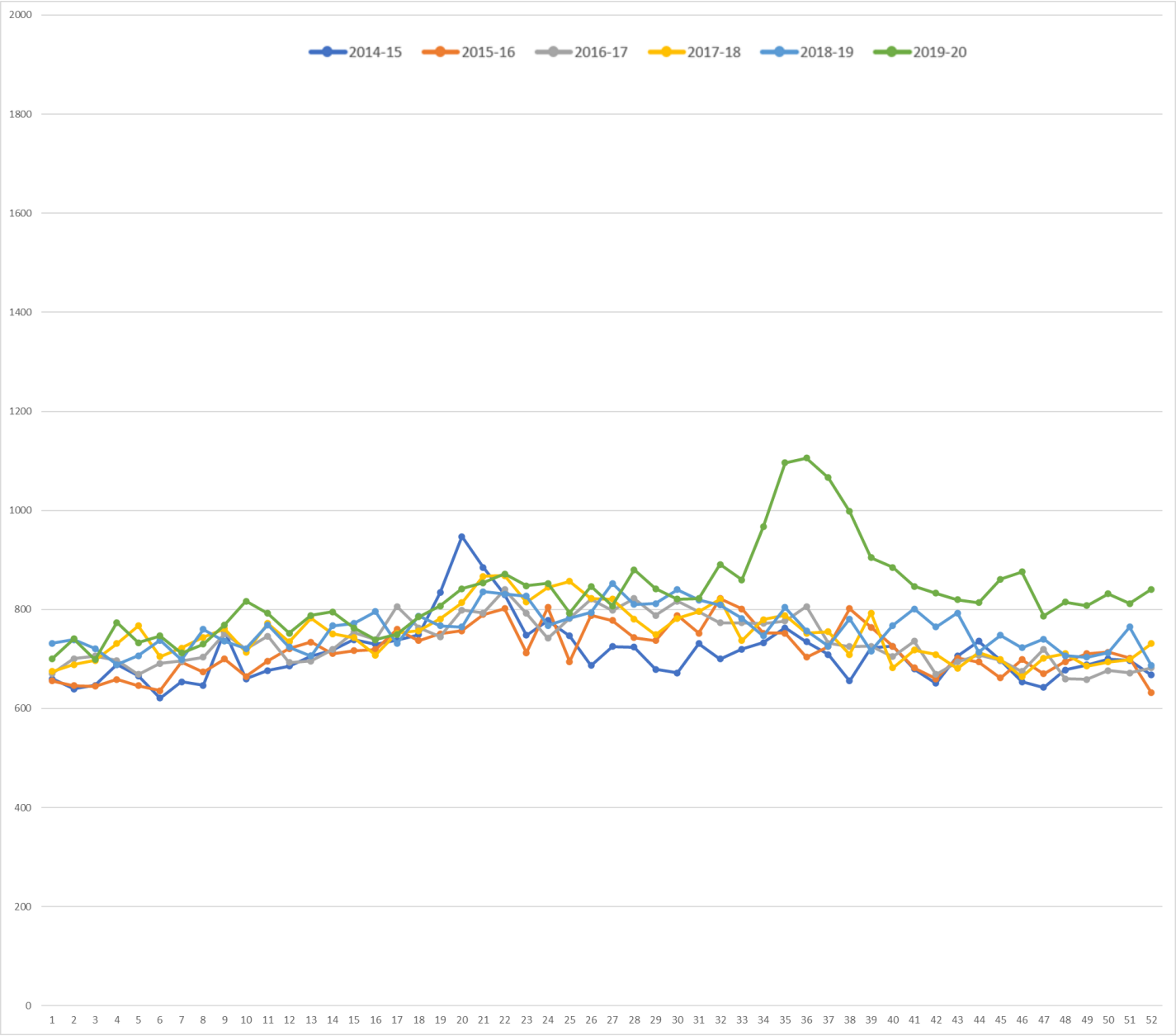
App. Graph 20: AR (Arkansas) All Cause Weekly Deaths, from season 2014-15 to season 2019-2



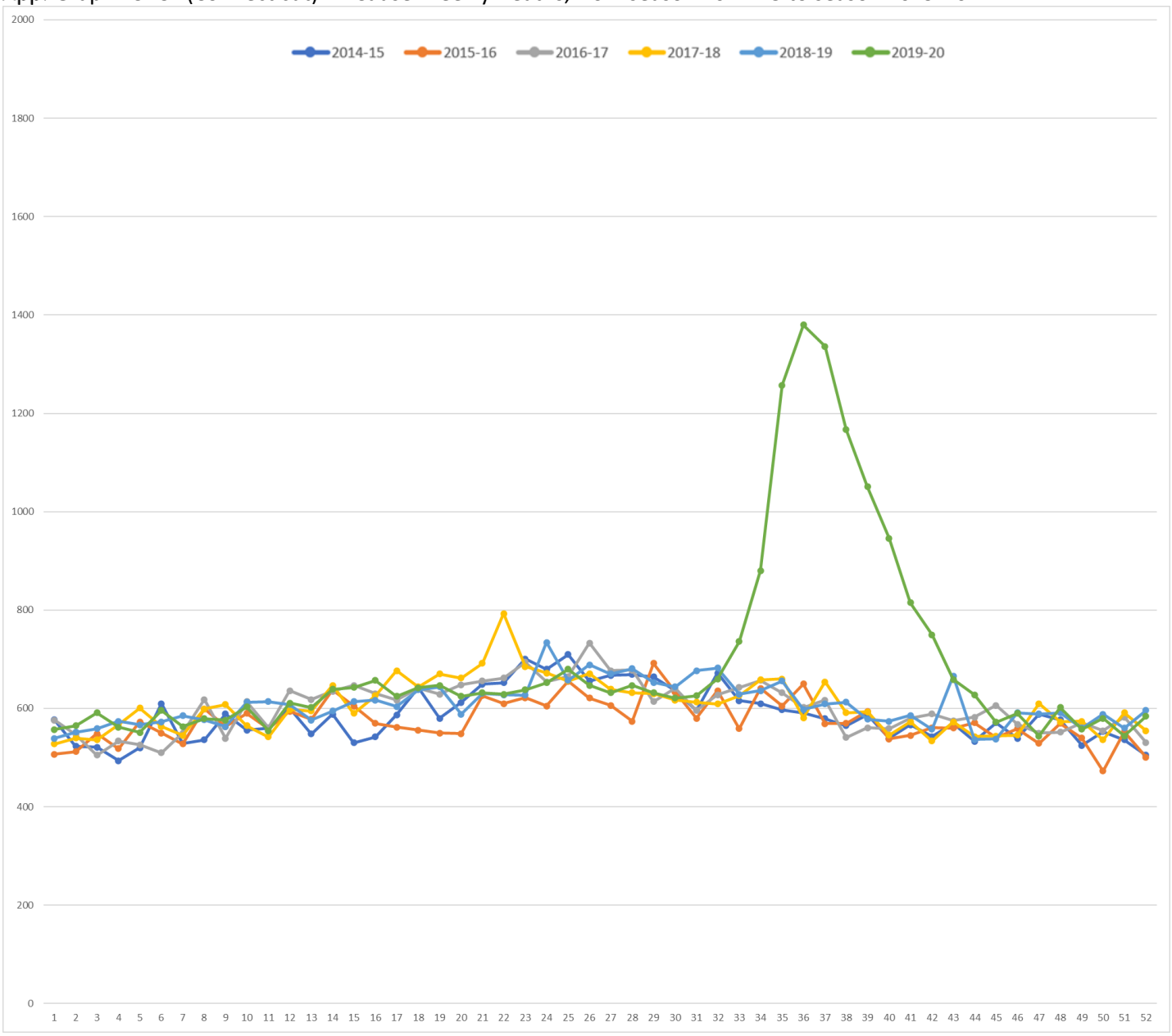
App. Graph 21: CA (California) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



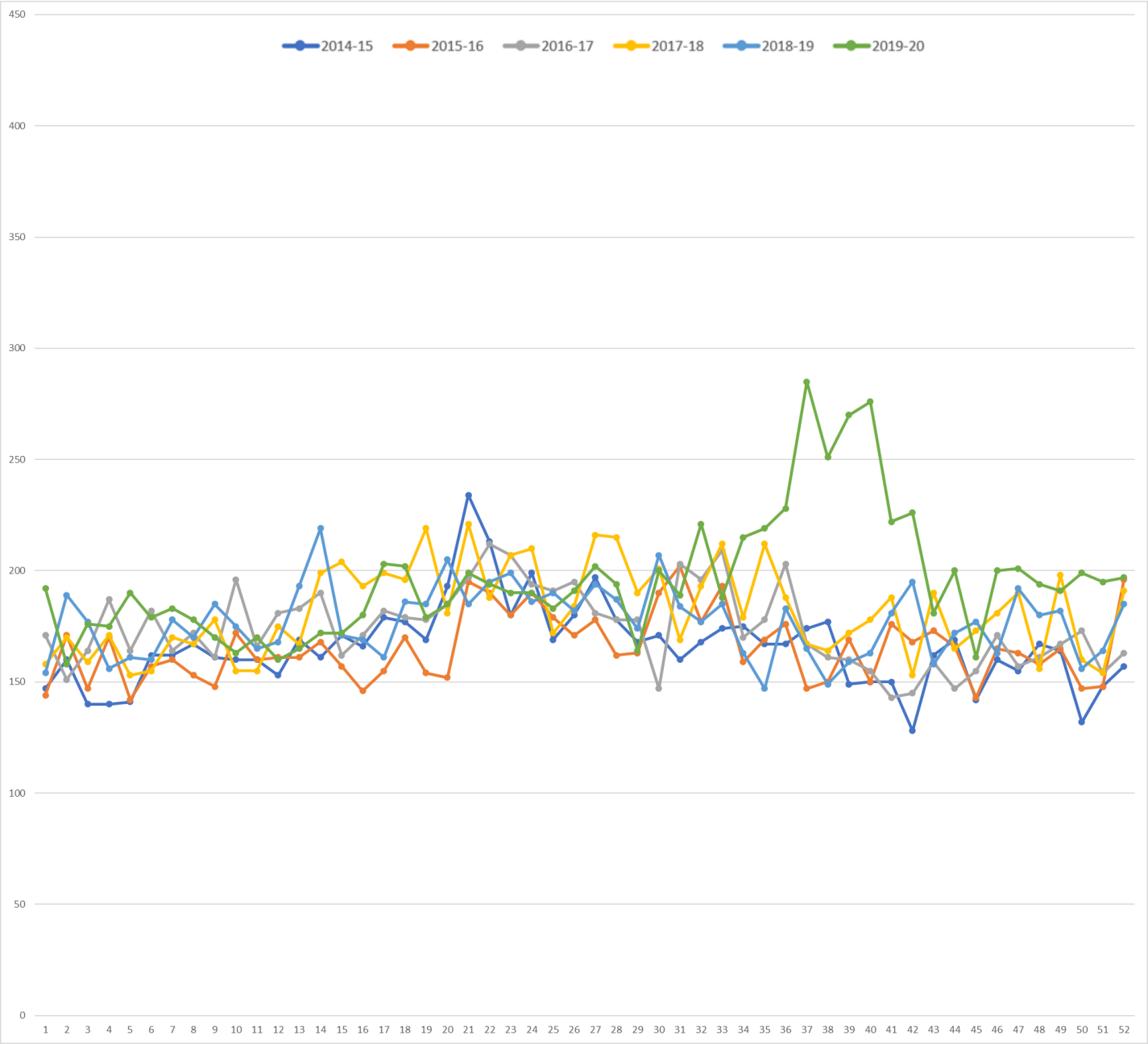
App. Graph 22: CO (Colorado) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



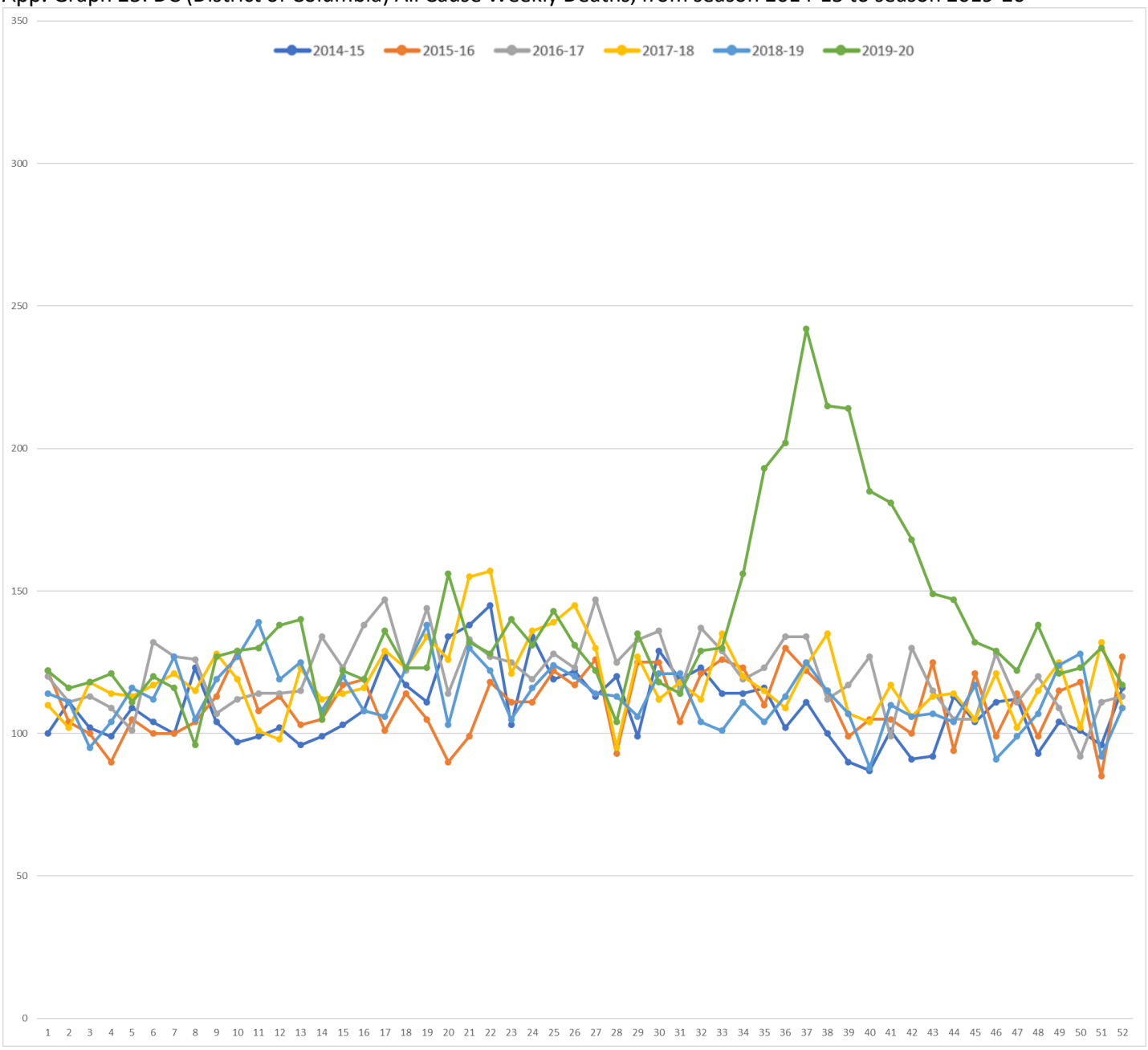
App. Graph 23: CT (Connecticut) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



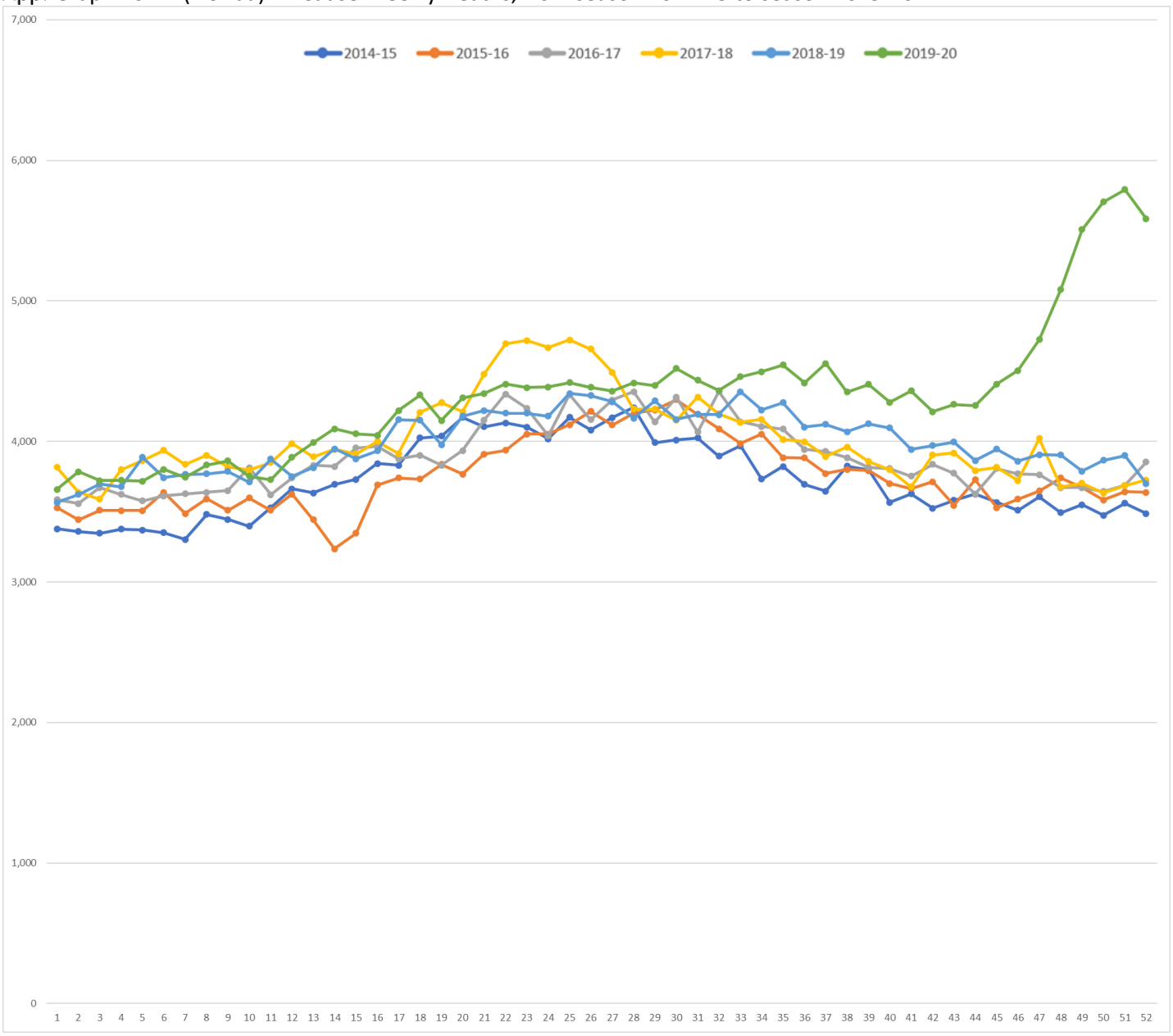
App. Graph 24: DE (Delaware) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



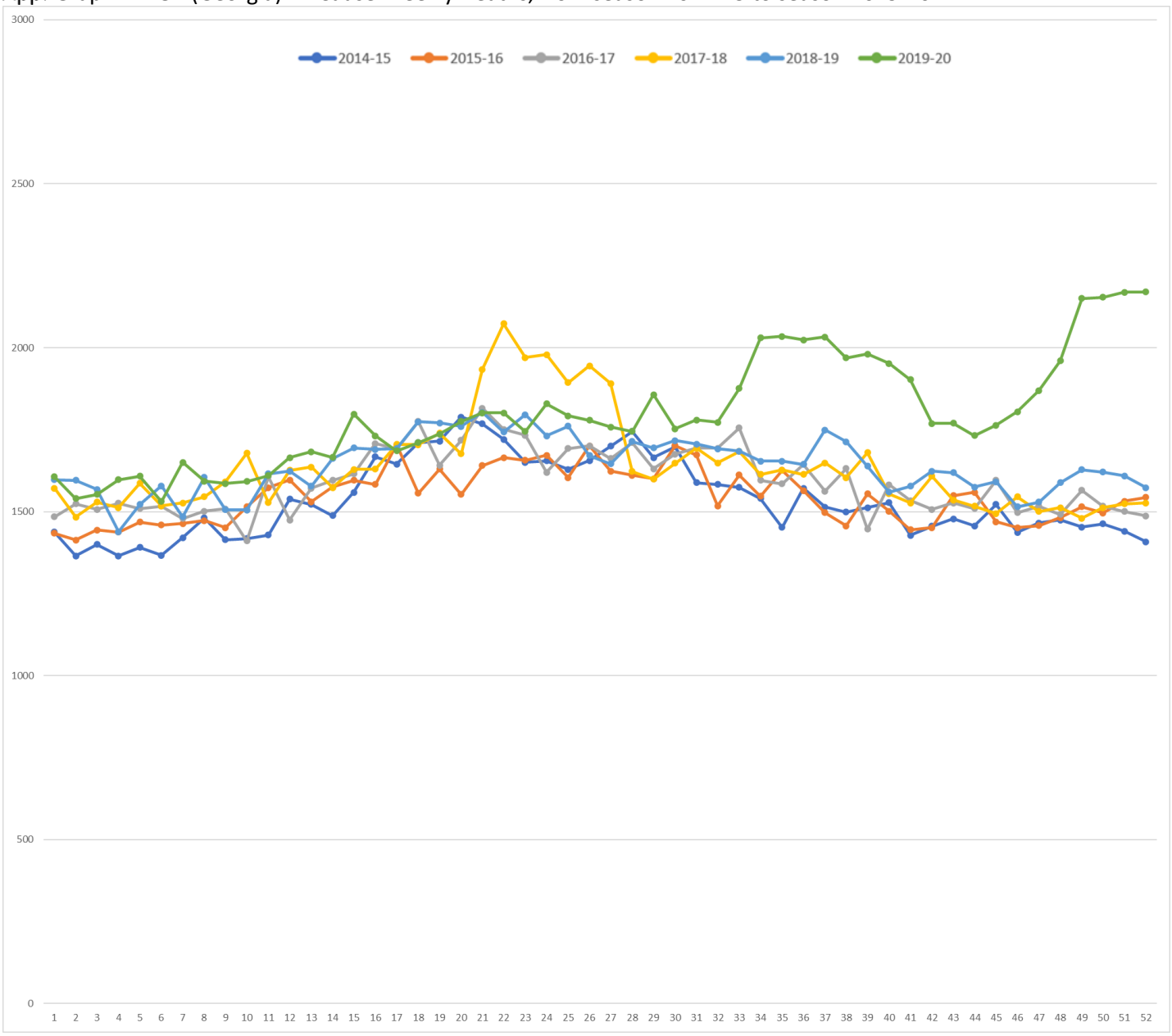
App. Graph 25: DC (District of Columbia) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



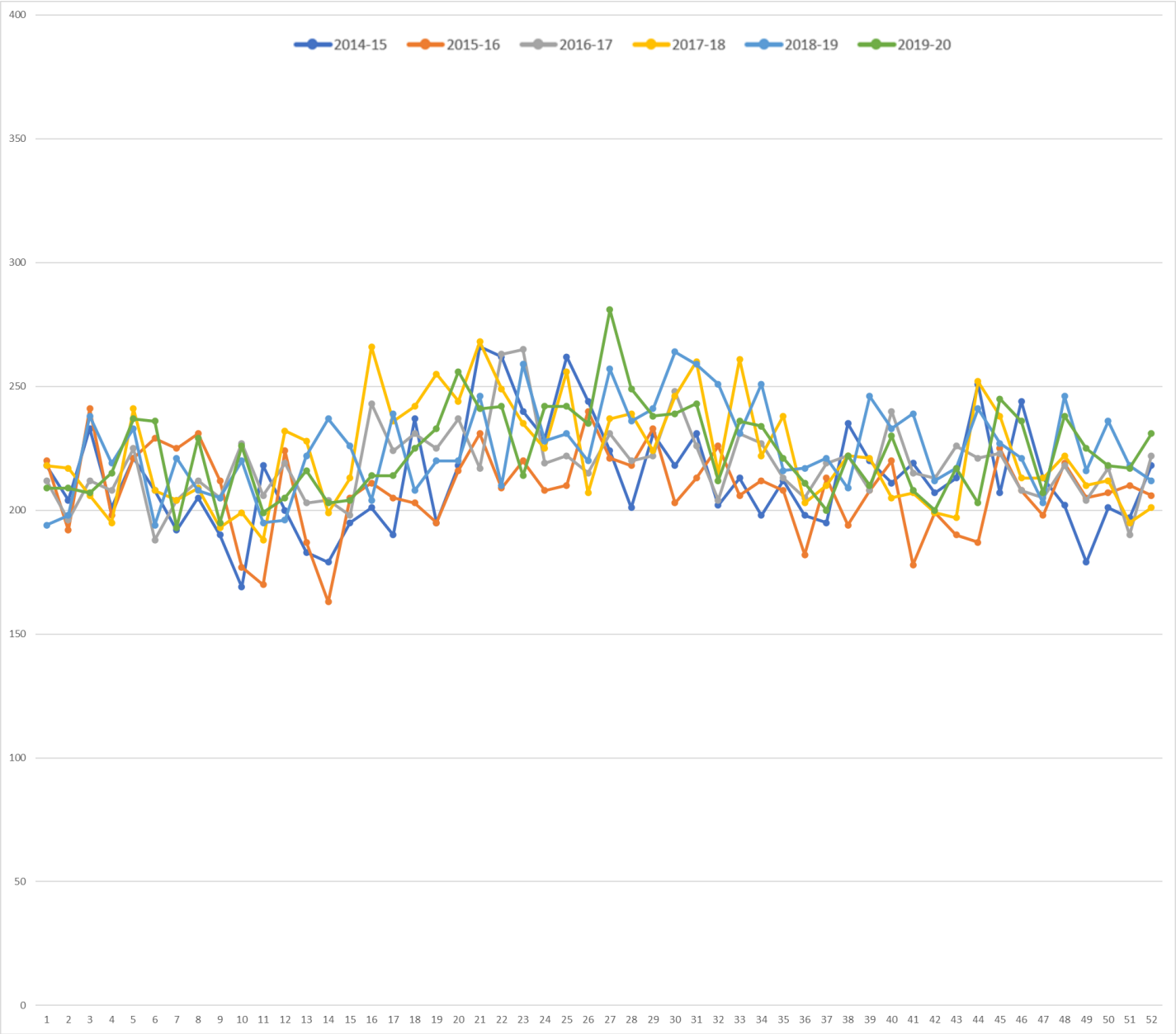
App. Graph 26: FL (Florida) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



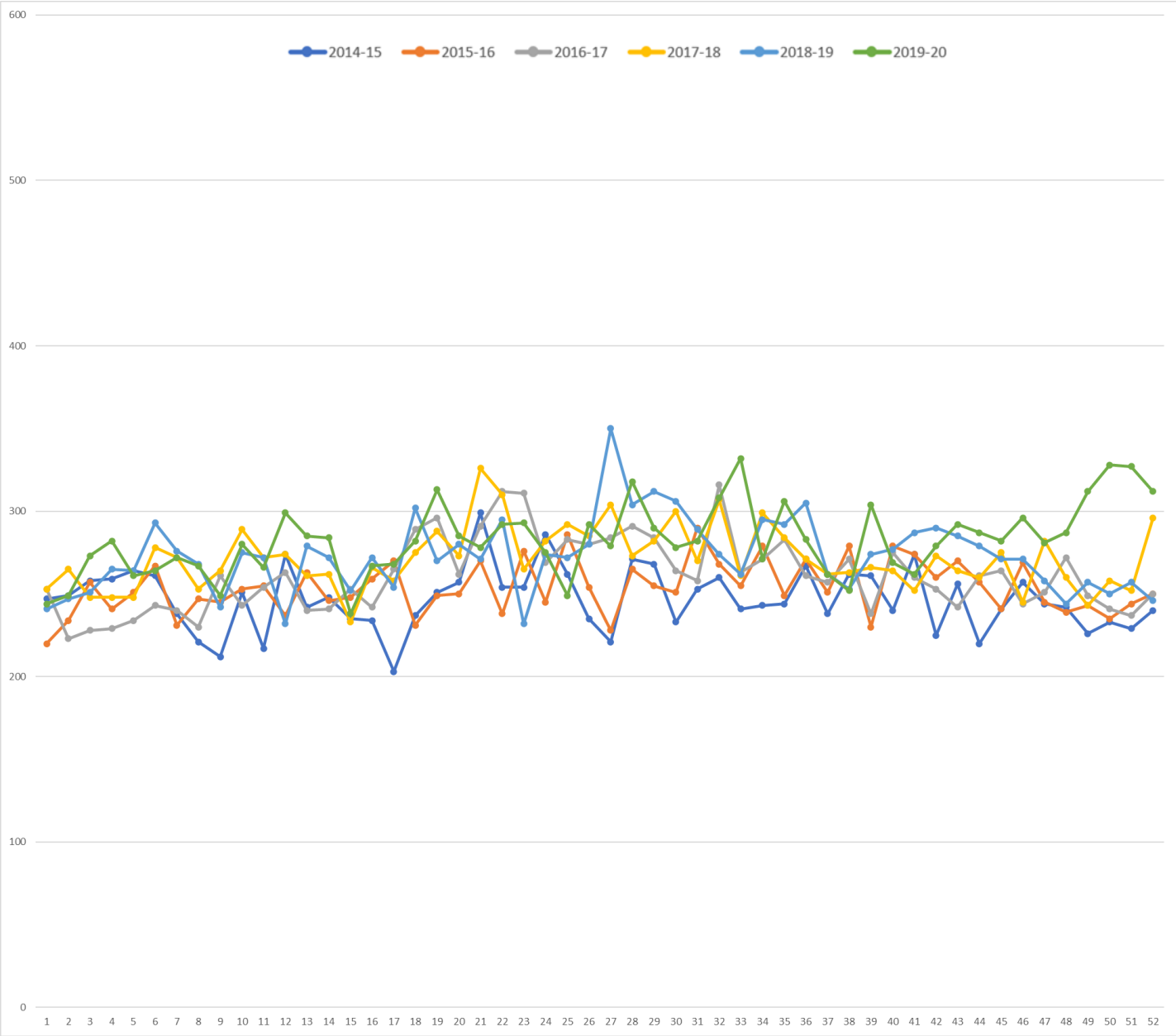
App. Graph 27: GA (Georgia) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



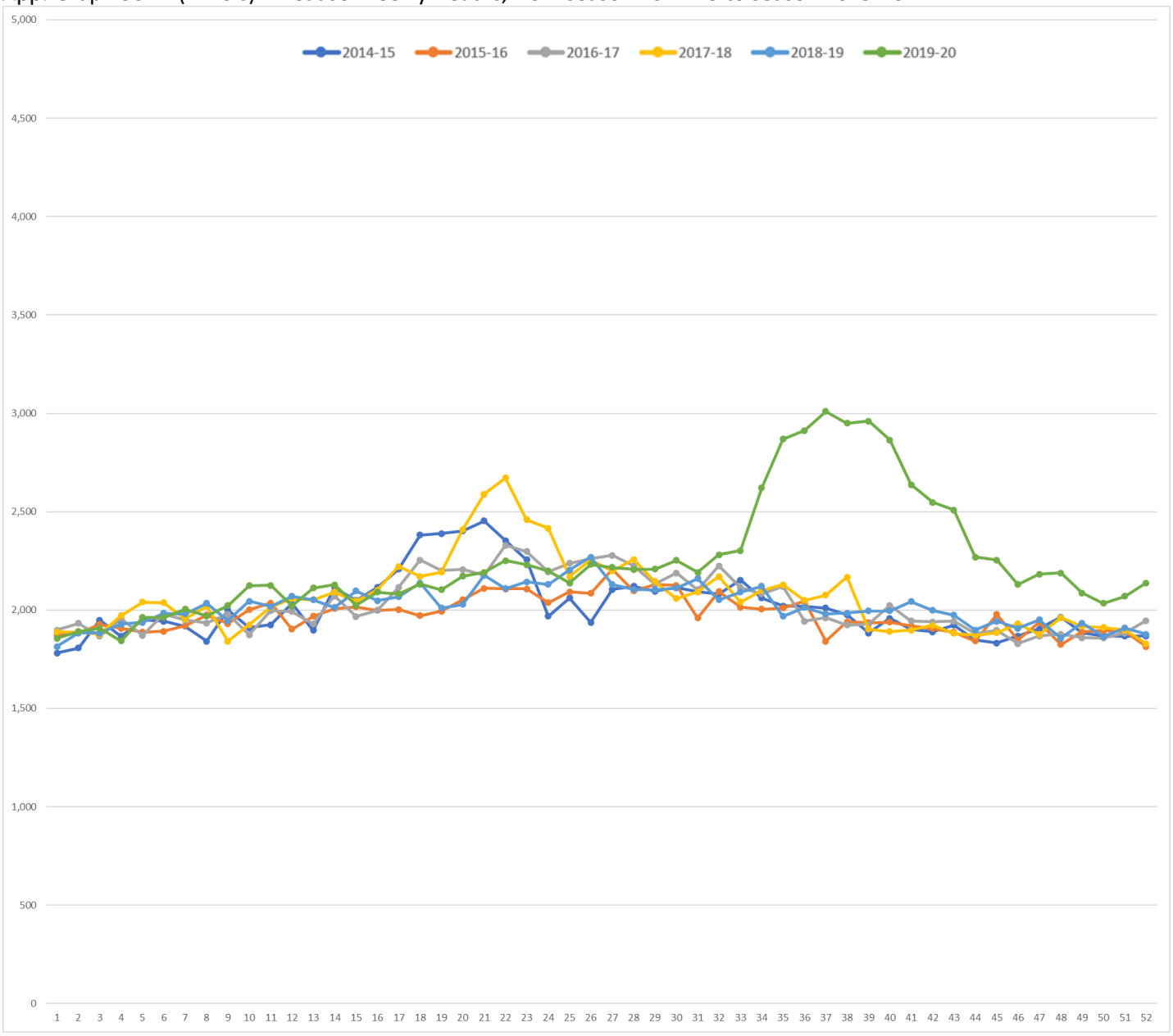
App. Graph 28: HI (Hawaii) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



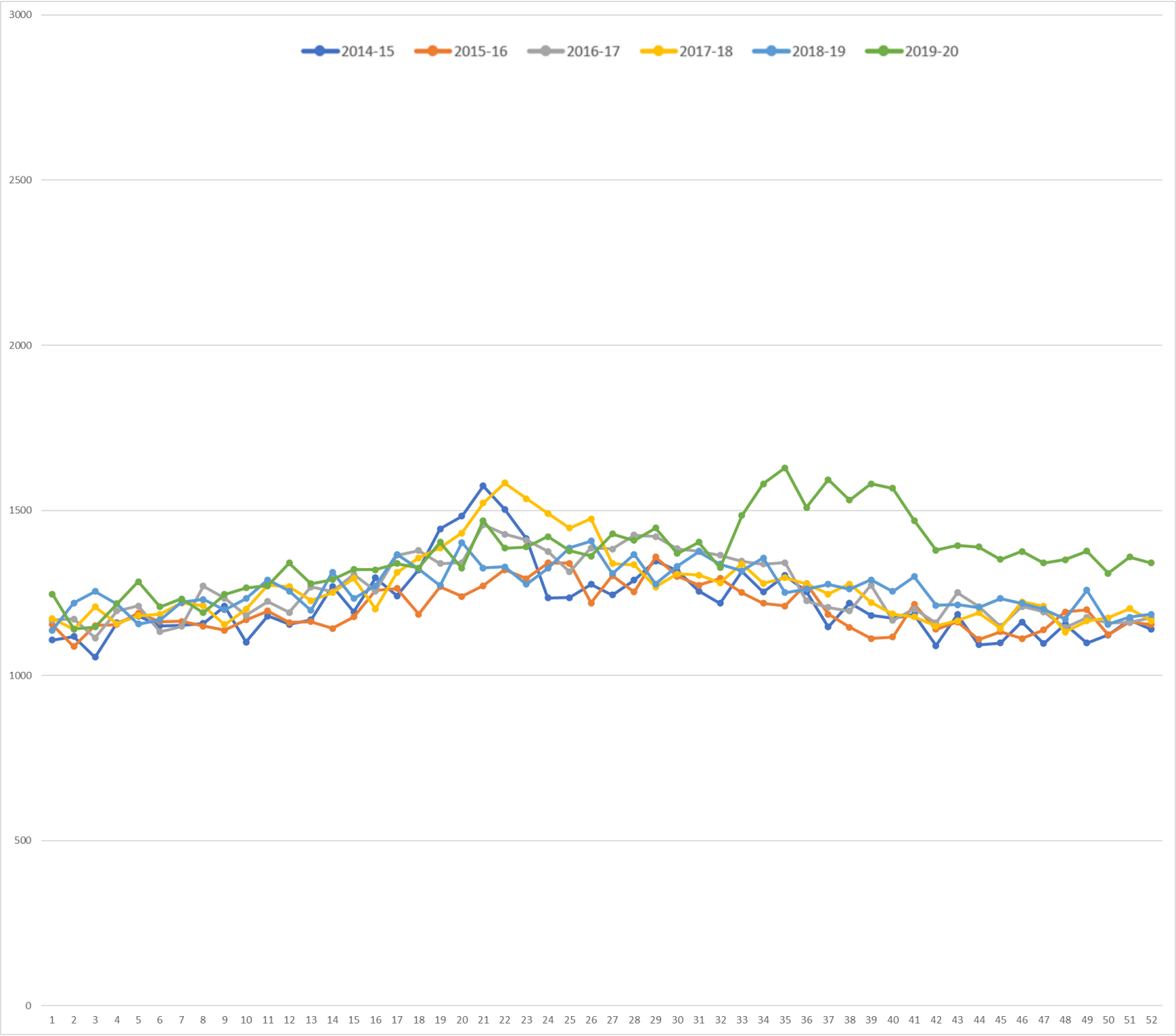
App. Graph 29: ID (Idaho) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



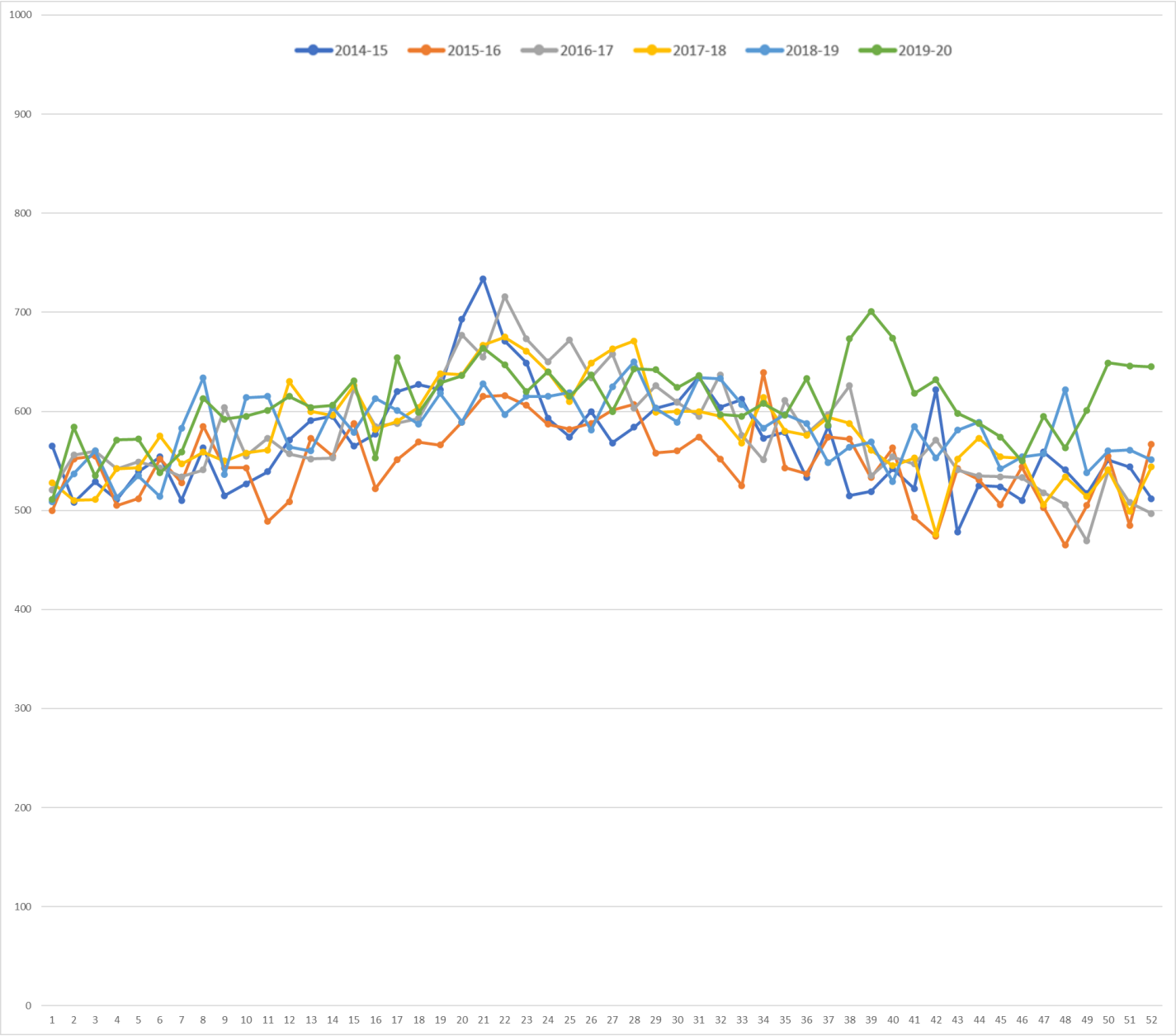
App. Graph 30: IL (Illinois) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



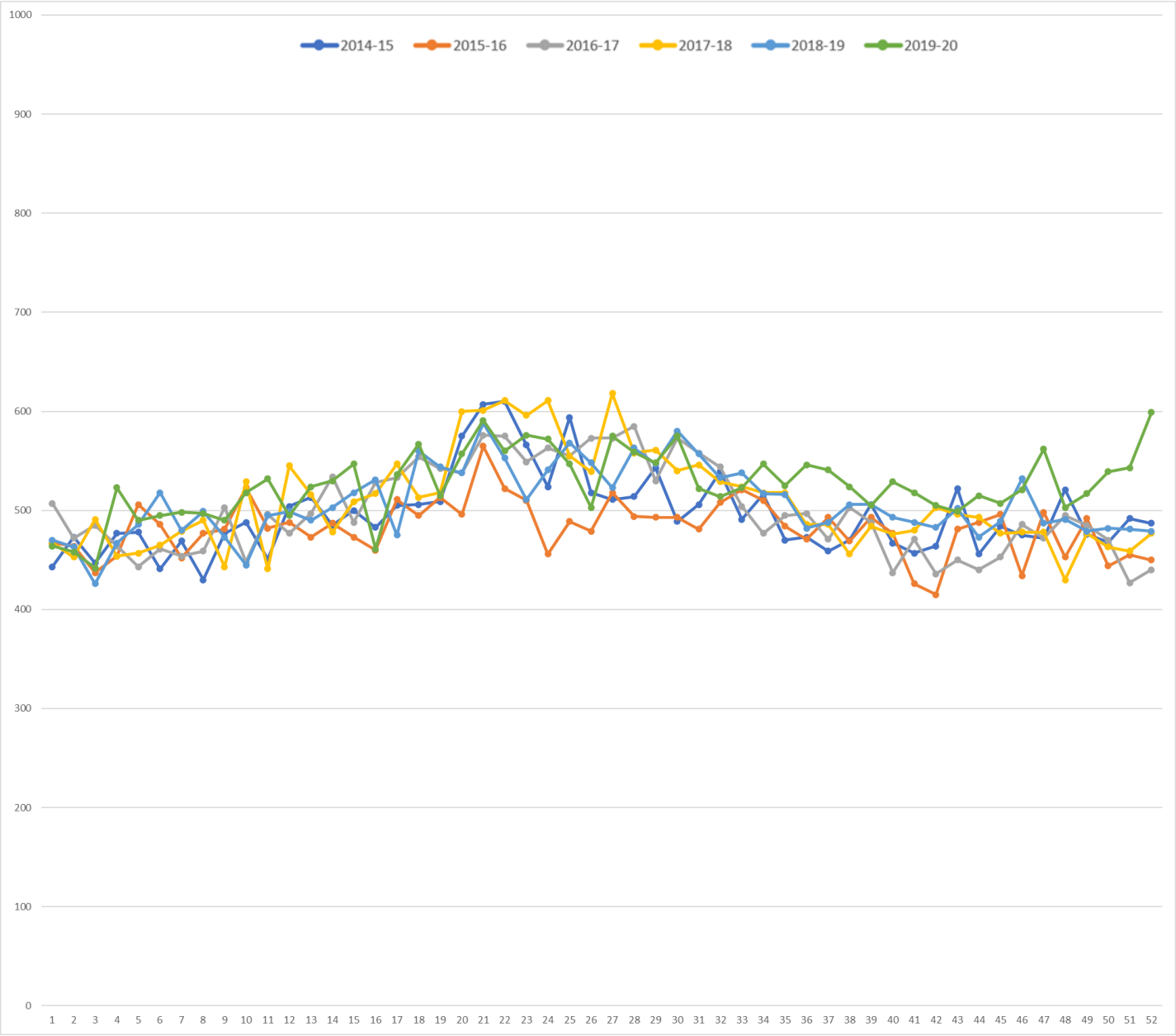
App. Graph 31: IN (Indiana) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



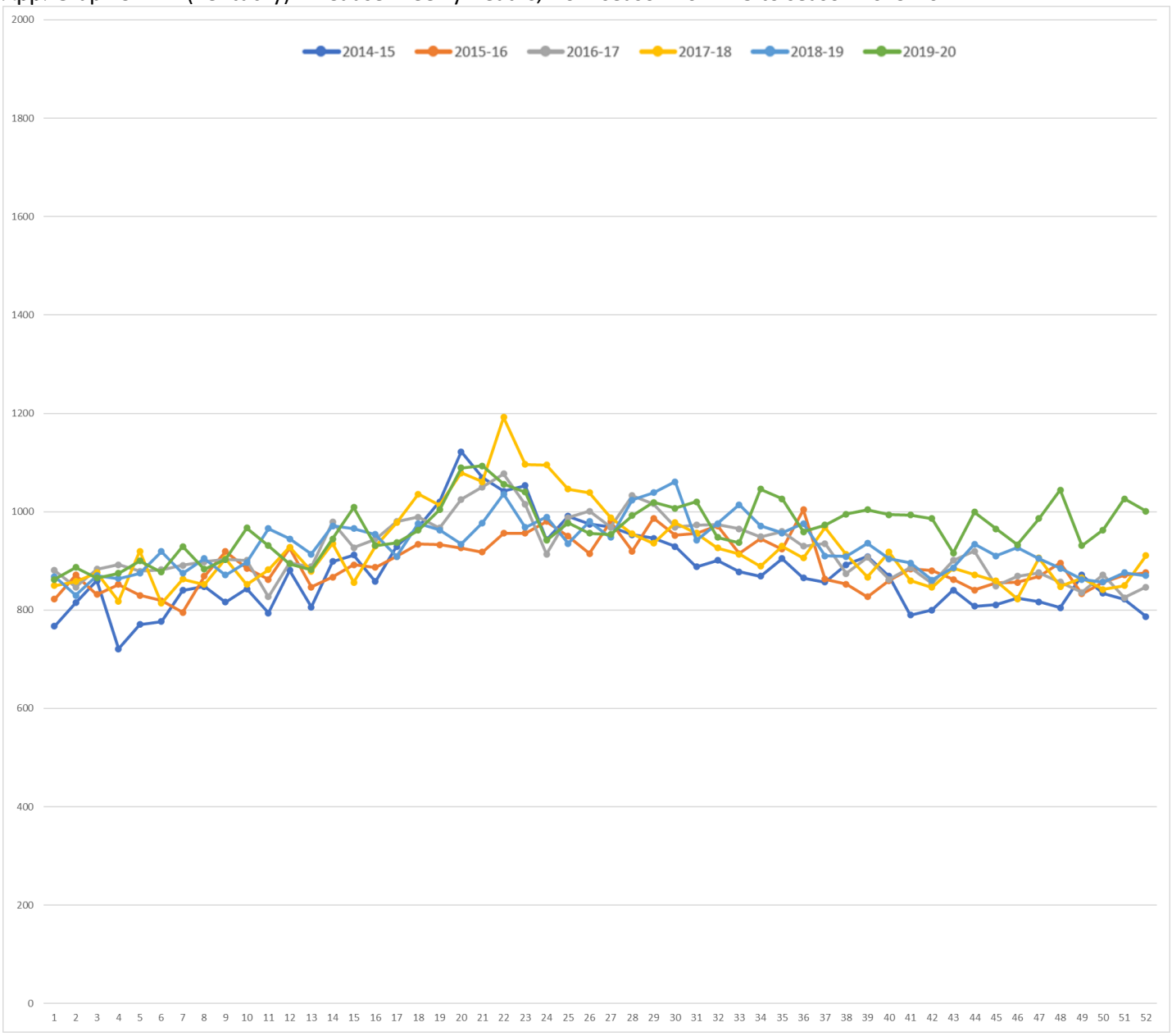
App. Graph 32: IA (Iowa) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



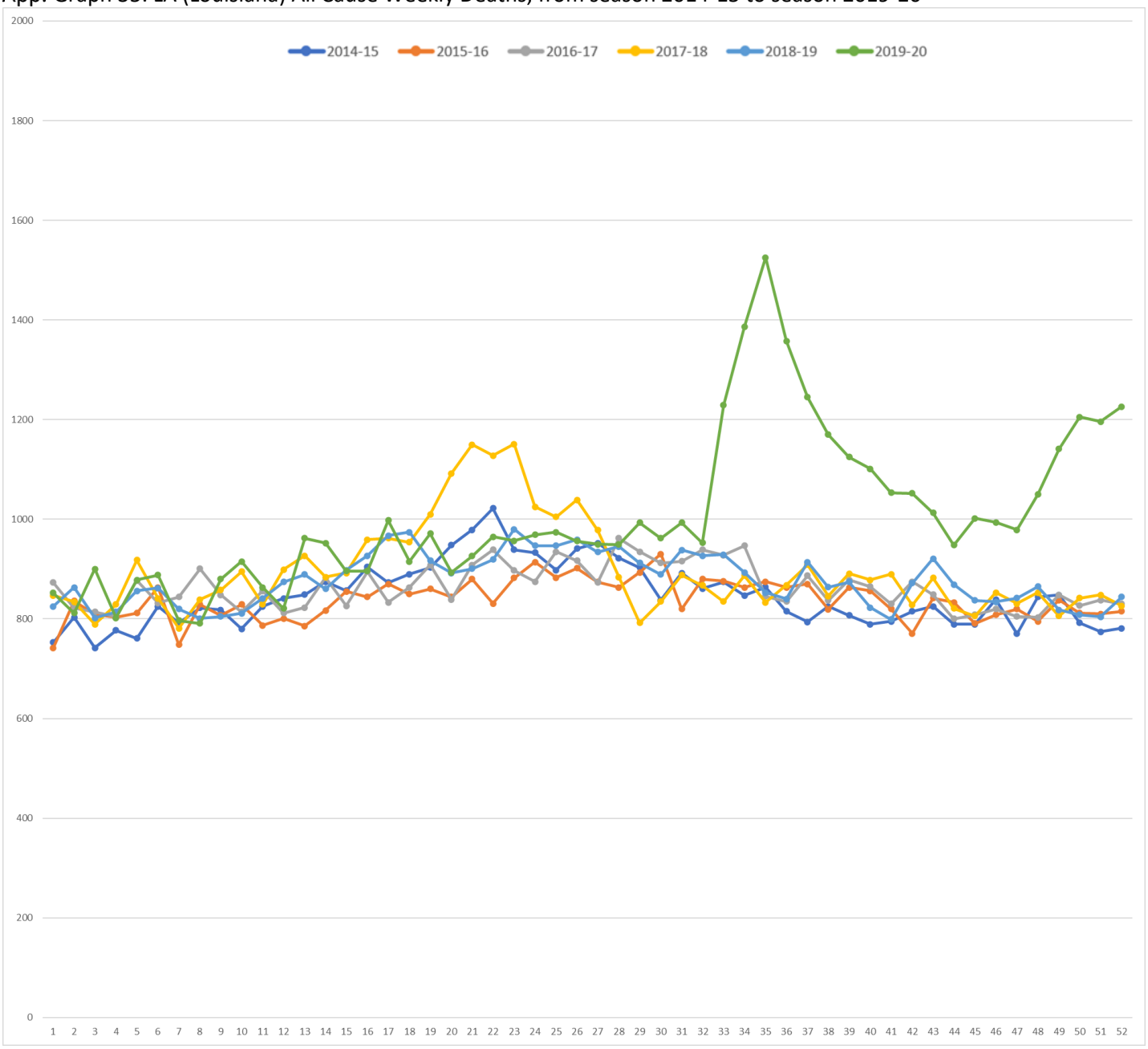
App. Graph 33: KS (Kansas) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



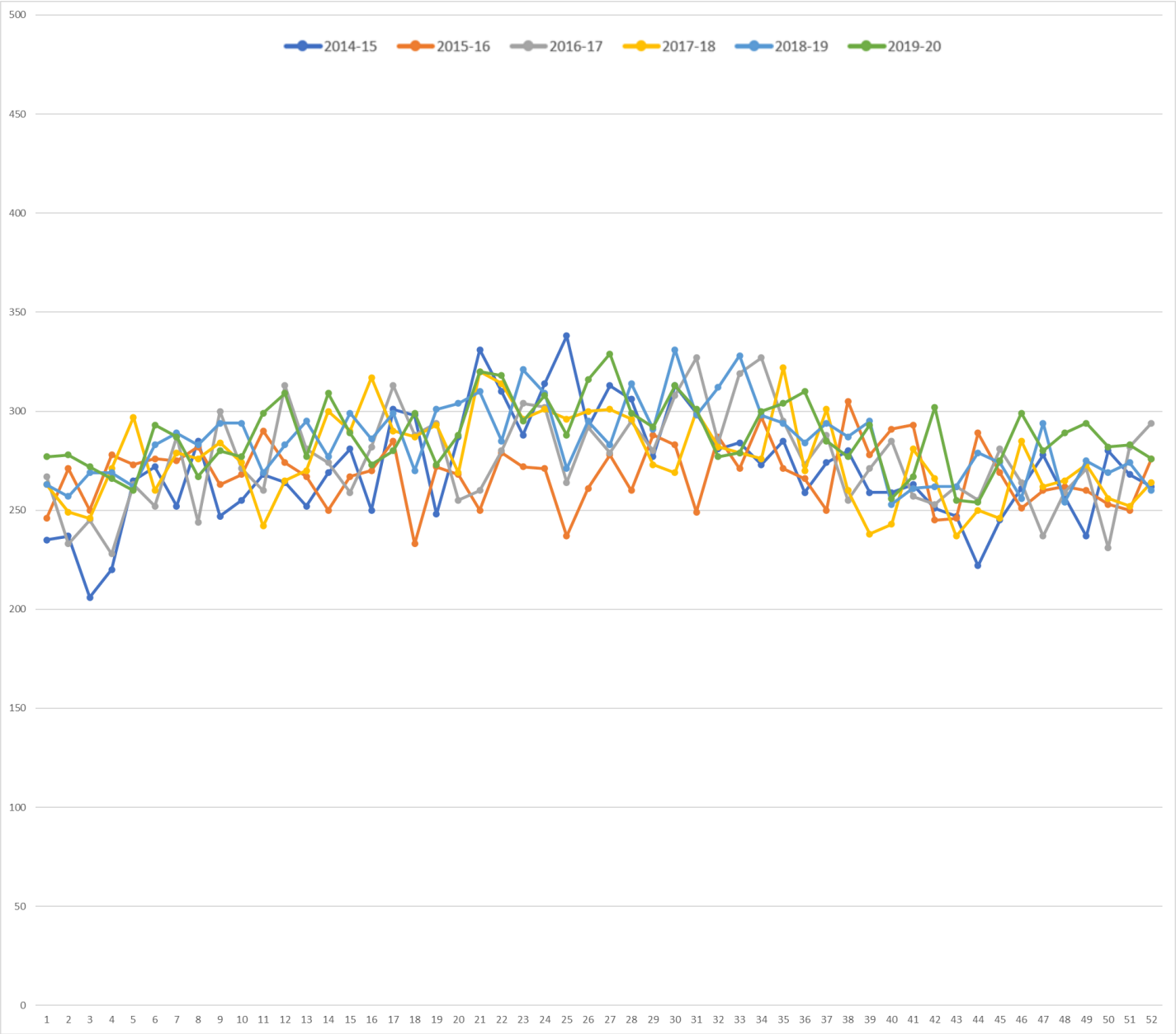
App. Graph 34: KY (Kentucky) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



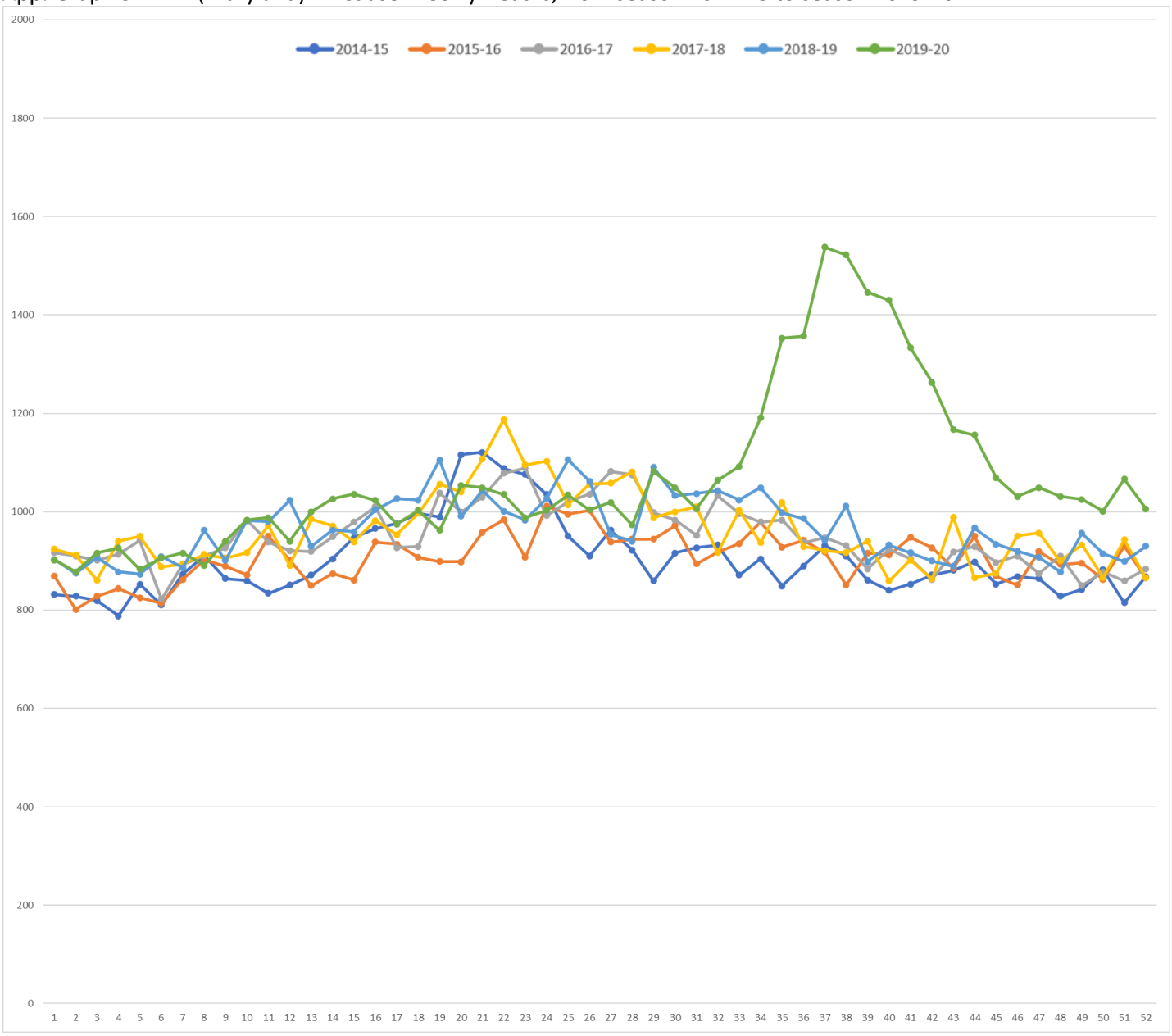
App. Graph 35: LA (Louisiana) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



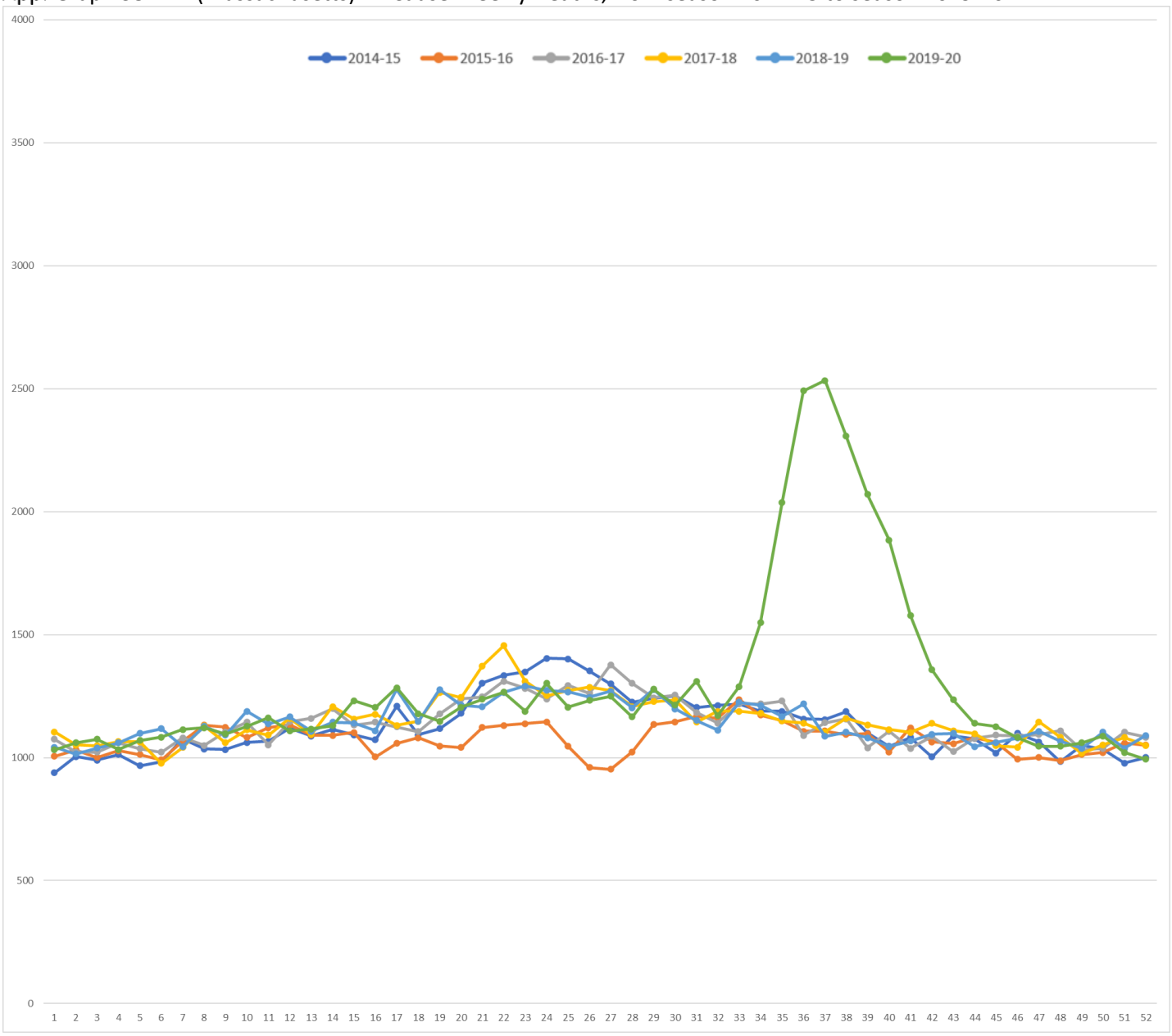
App. Graph 36: ME (Maine) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



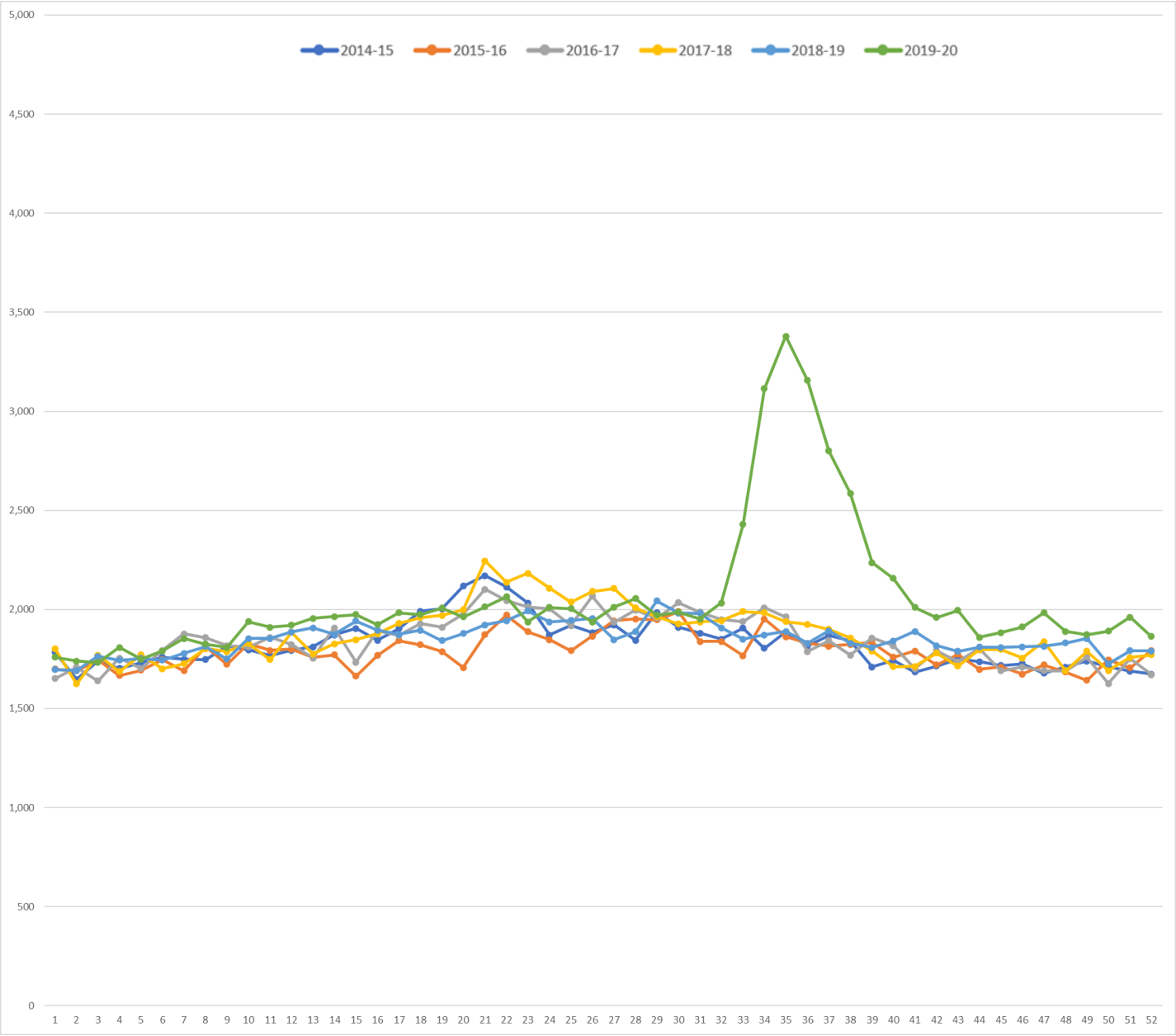
App. Graph 37: MD (Maryland) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



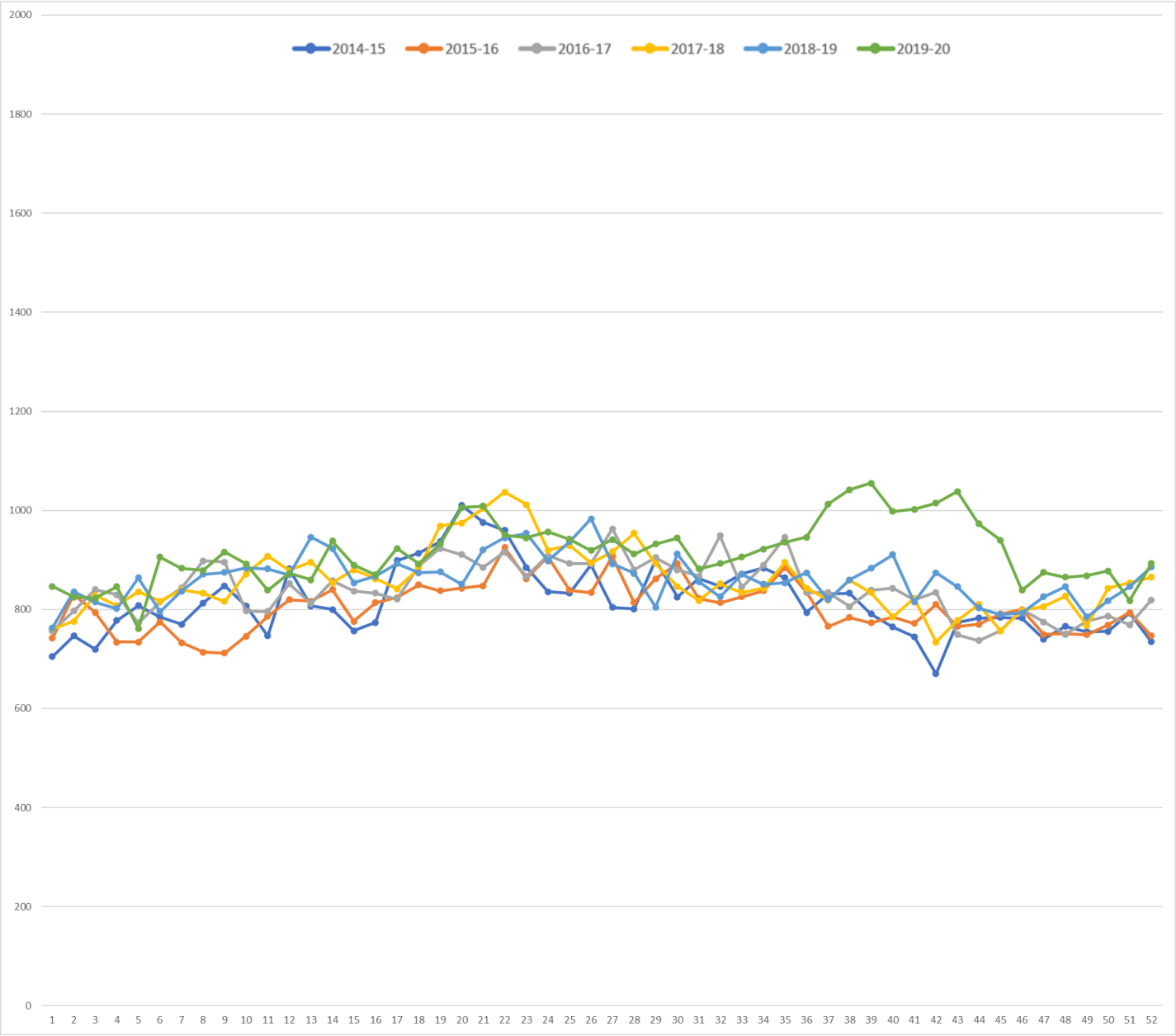
App. Graph 38: MA (Massachusetts) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



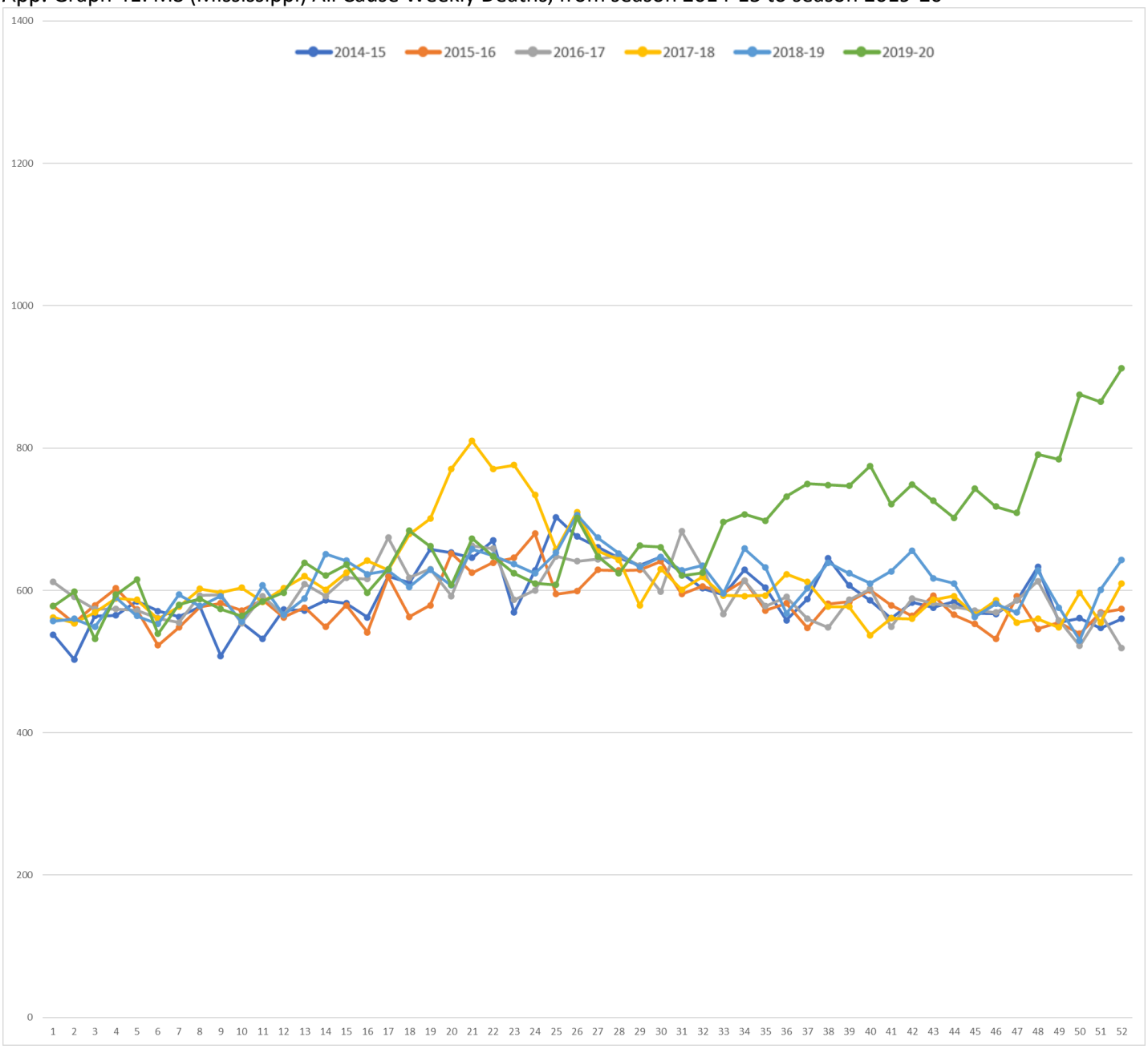
App. Graph 39: MI (Michigan) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



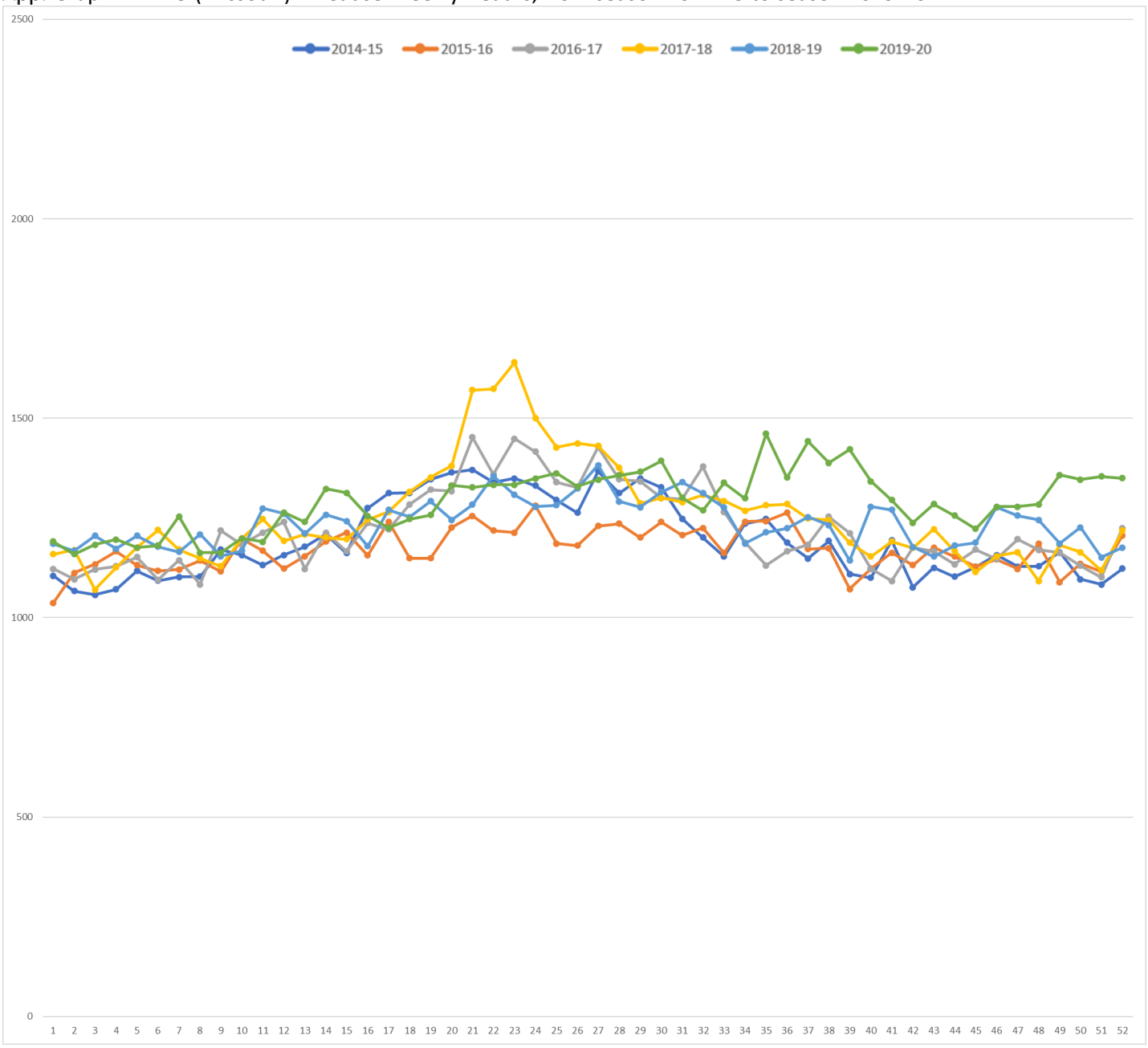
App. Graph 40: MN (Minnesota) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



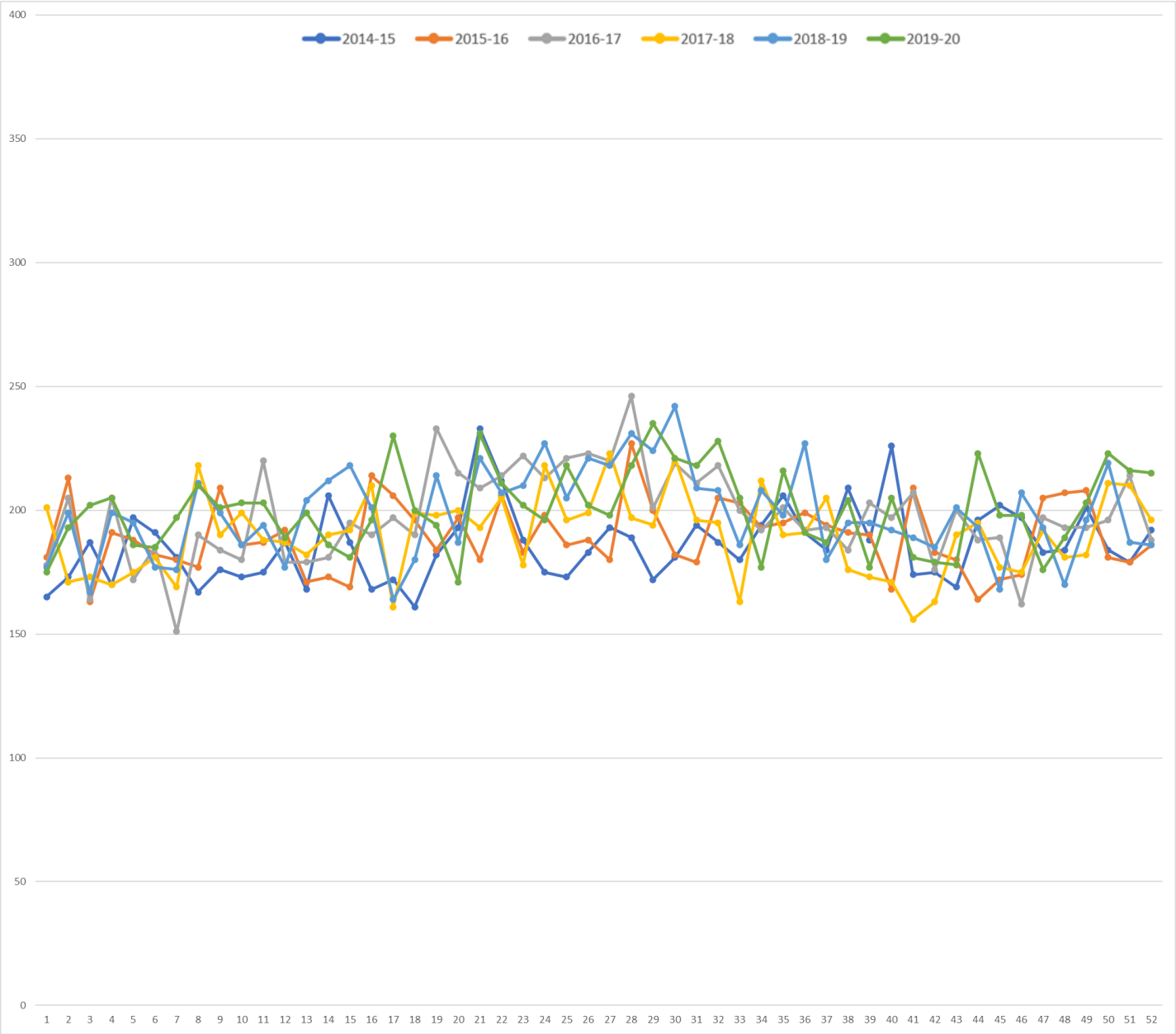
App. Graph 41: MS (Mississippi) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



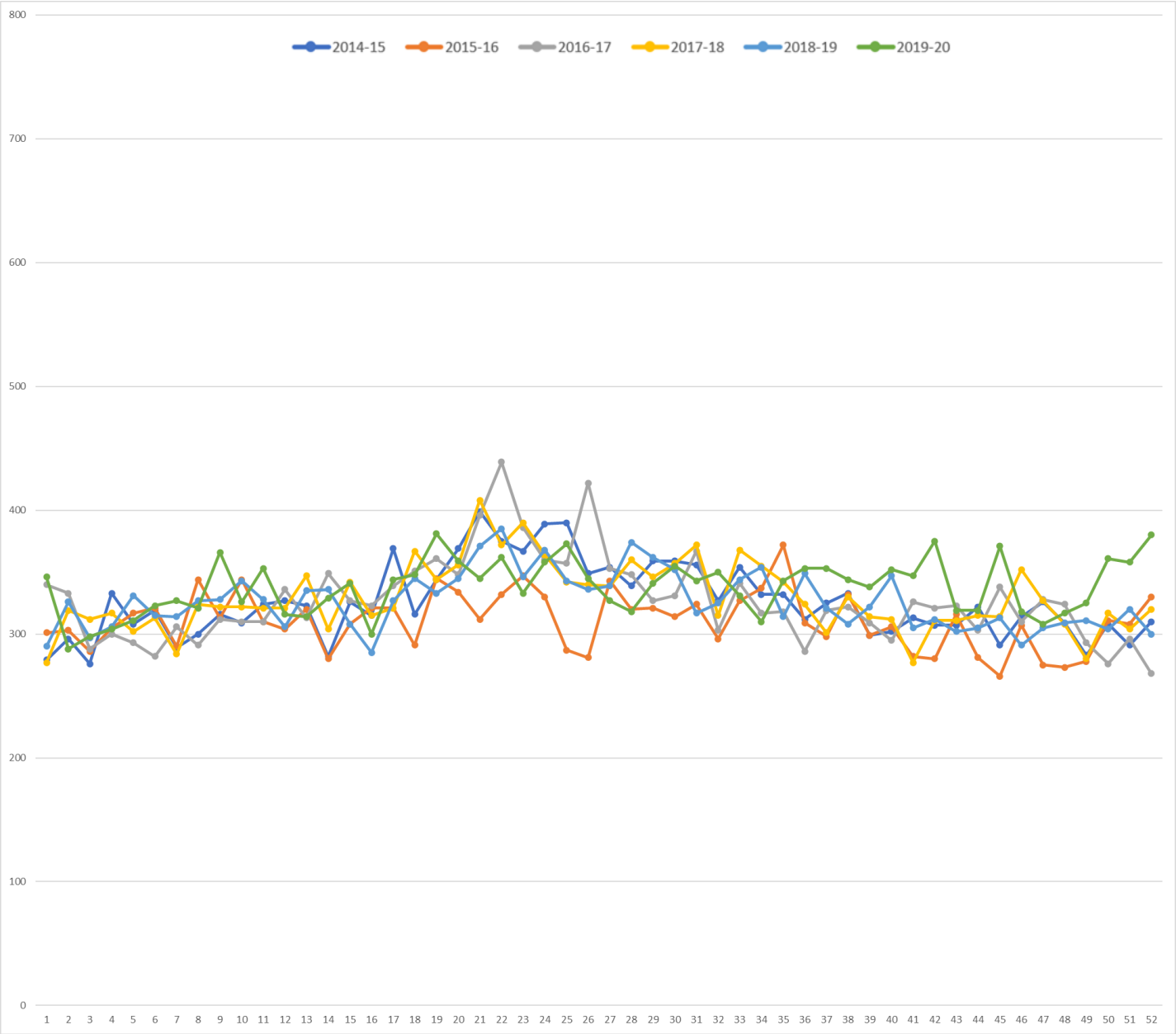
App. Graph 42: MO (Missouri) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



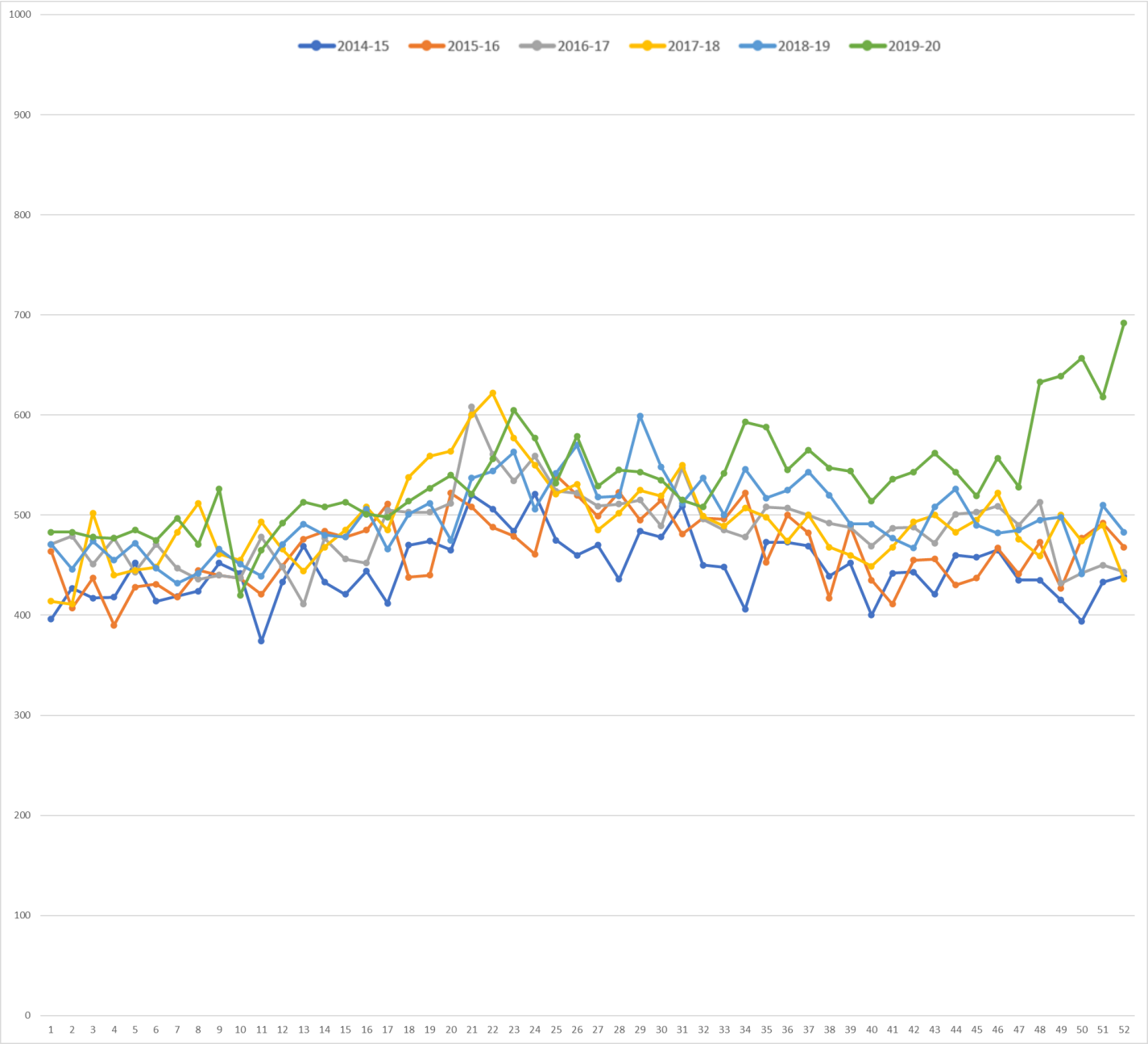
App. Graph 43: MT (Montana) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



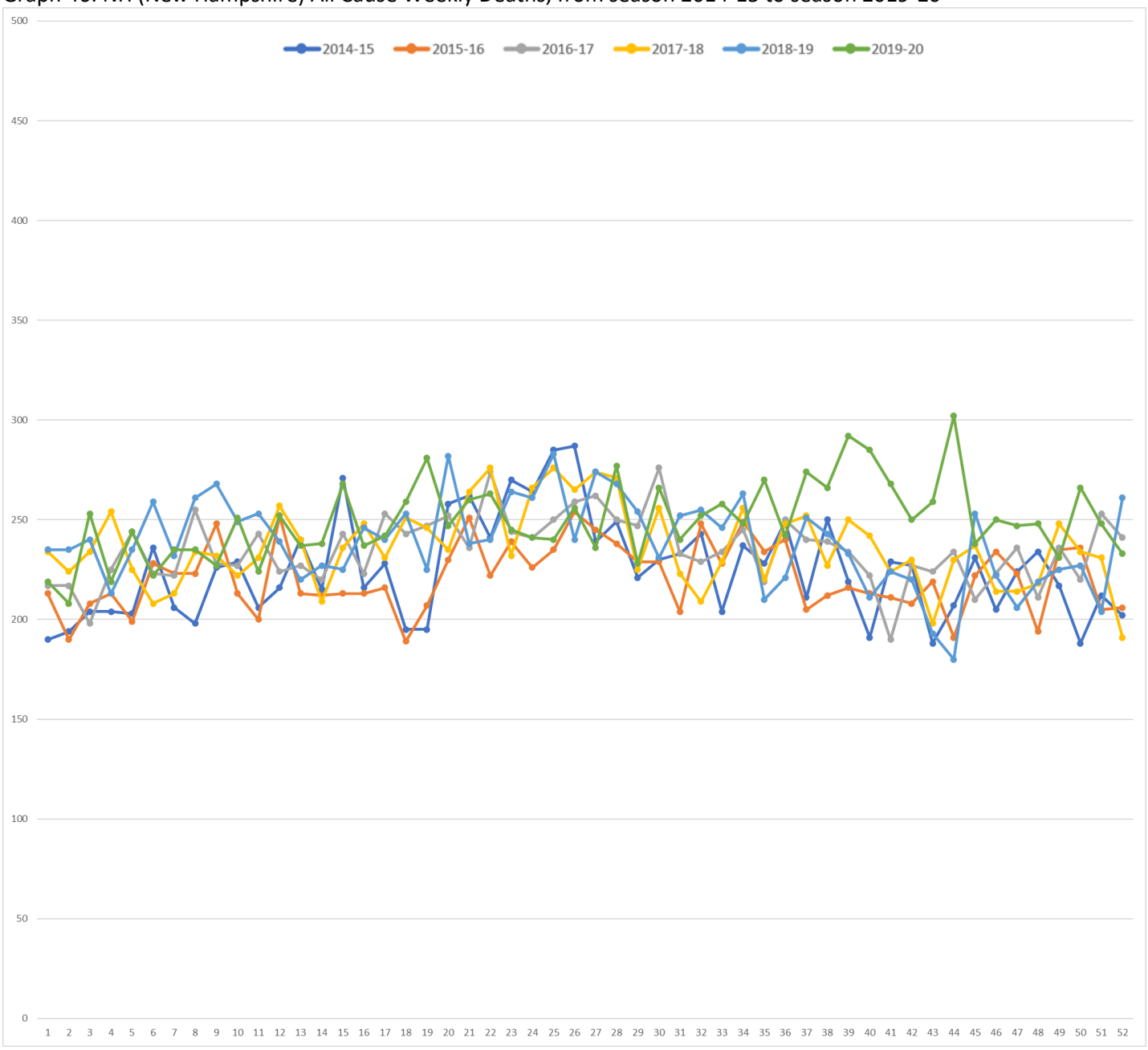
App. Graph 44: NE (Nebraska) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



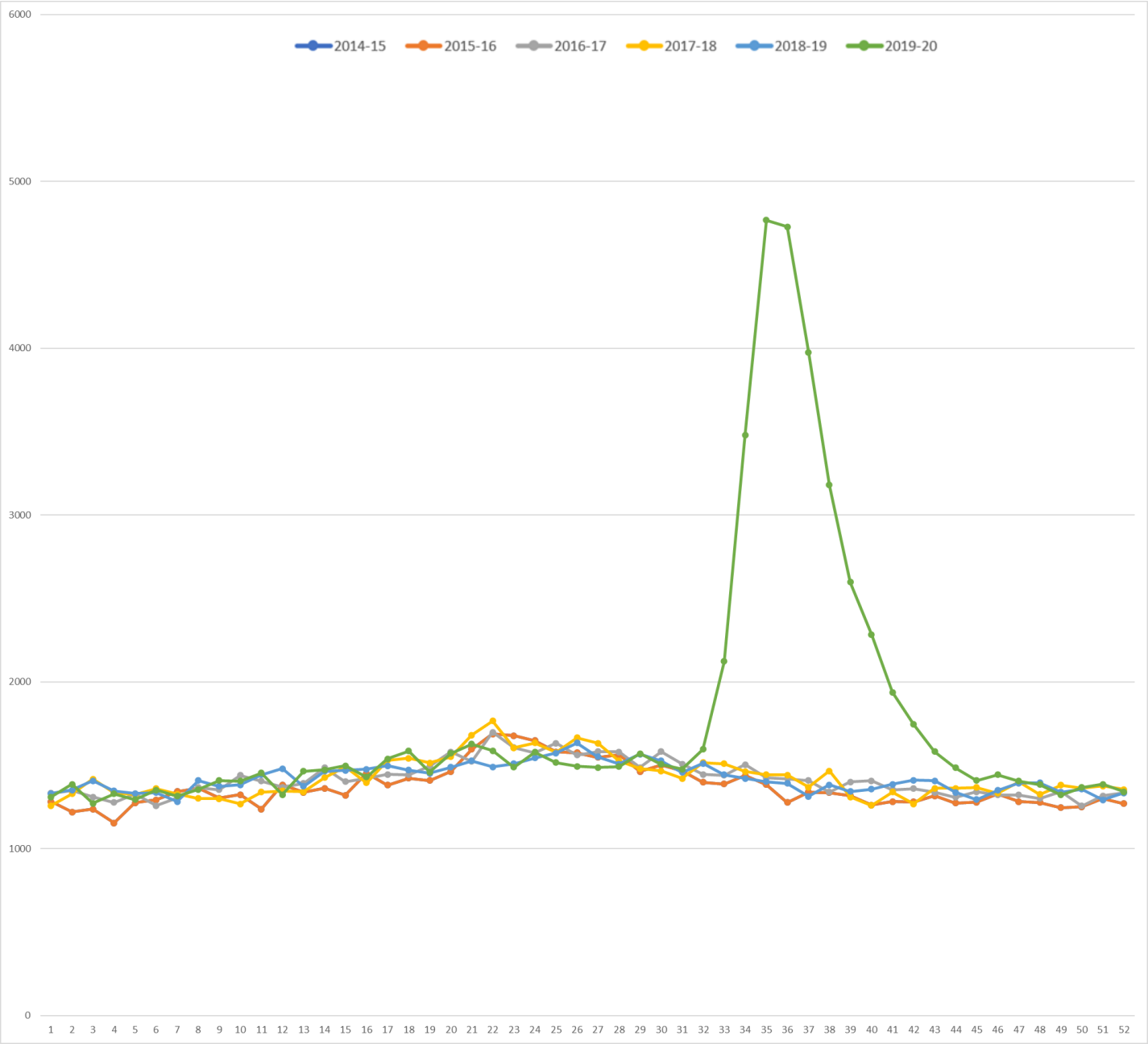
App. Graph 45: NV (Nevada) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



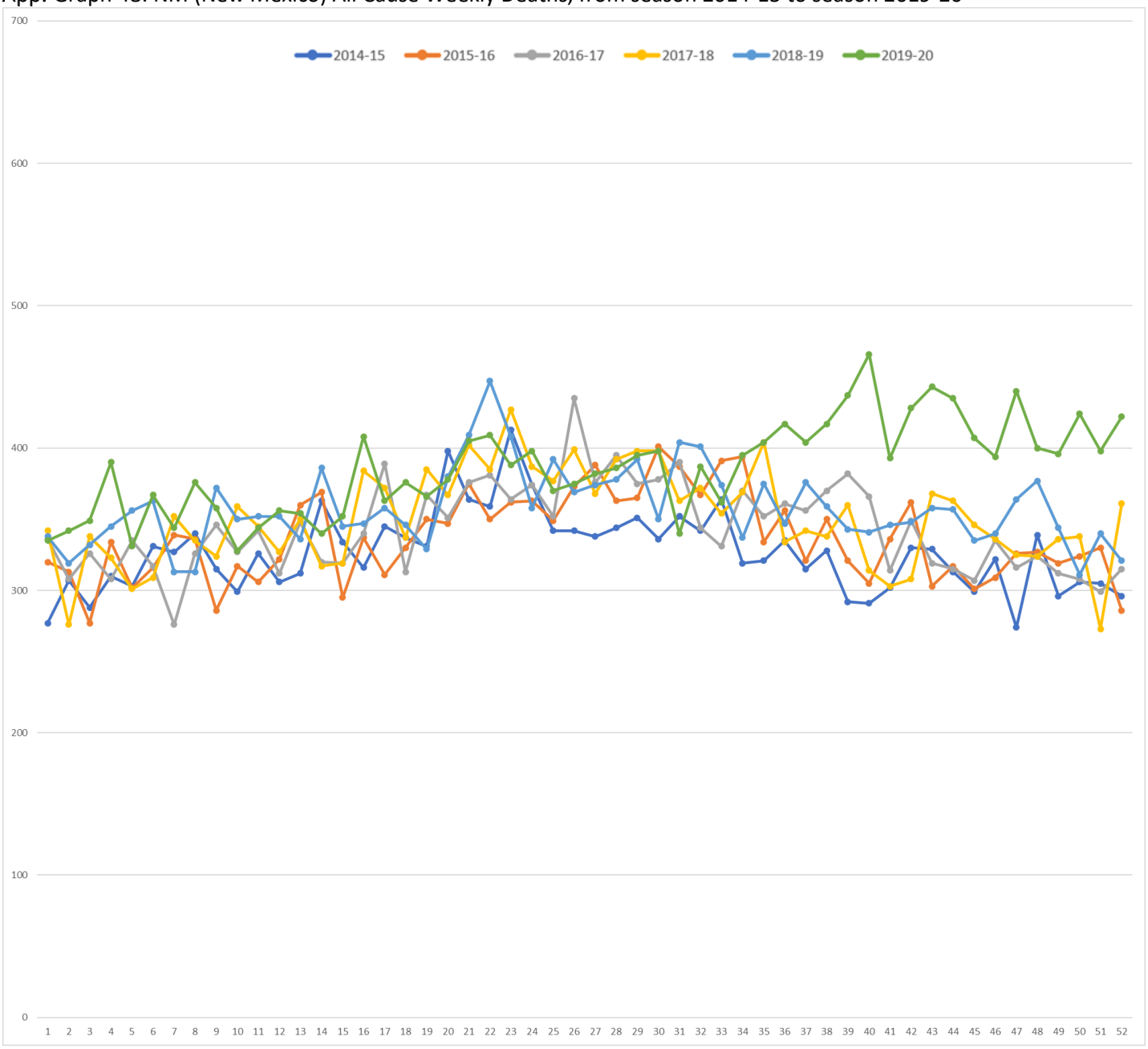
Graph 46: NH (New Hampshire) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



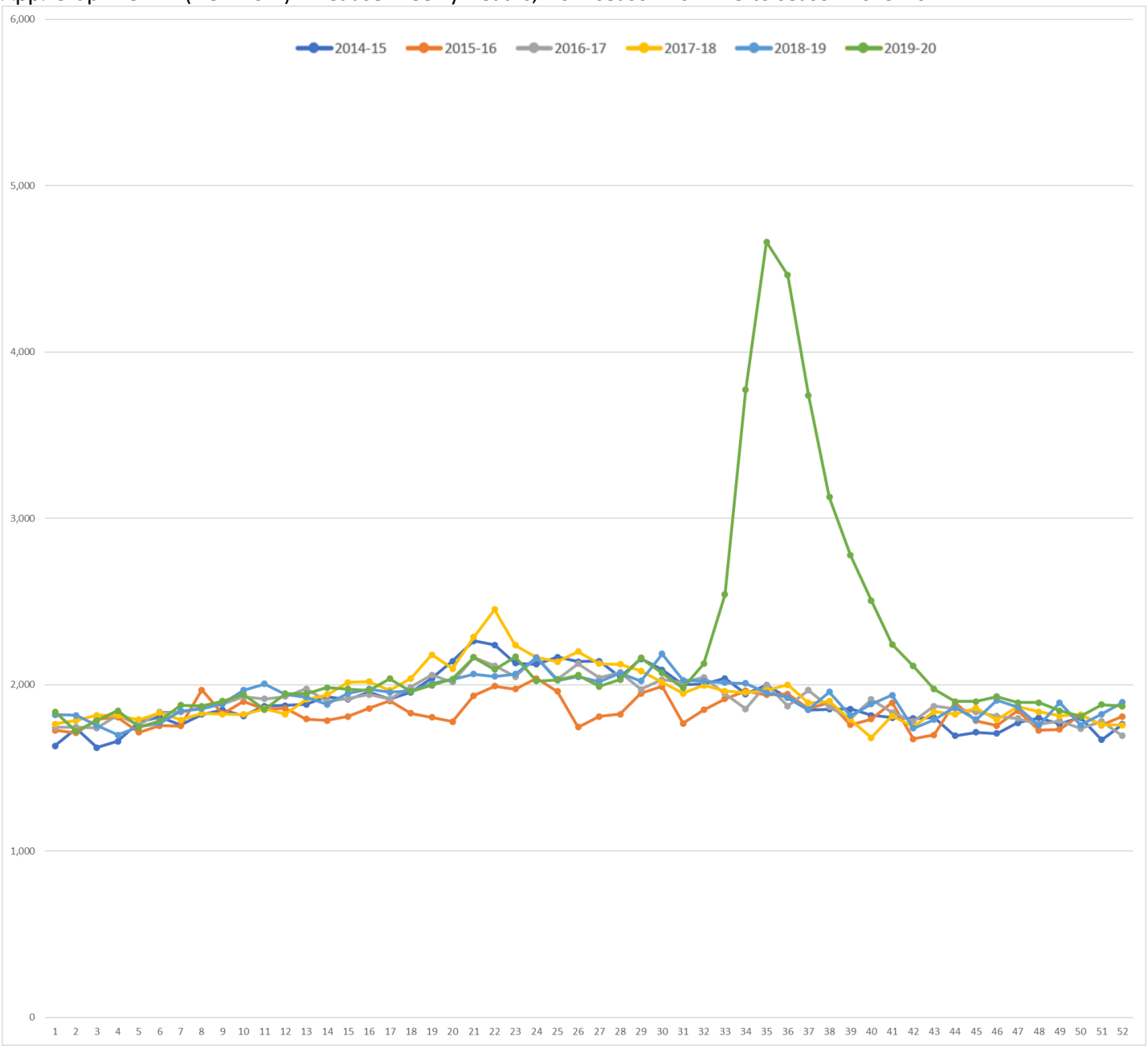
App. Graph 47: NJ (New Jersey) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



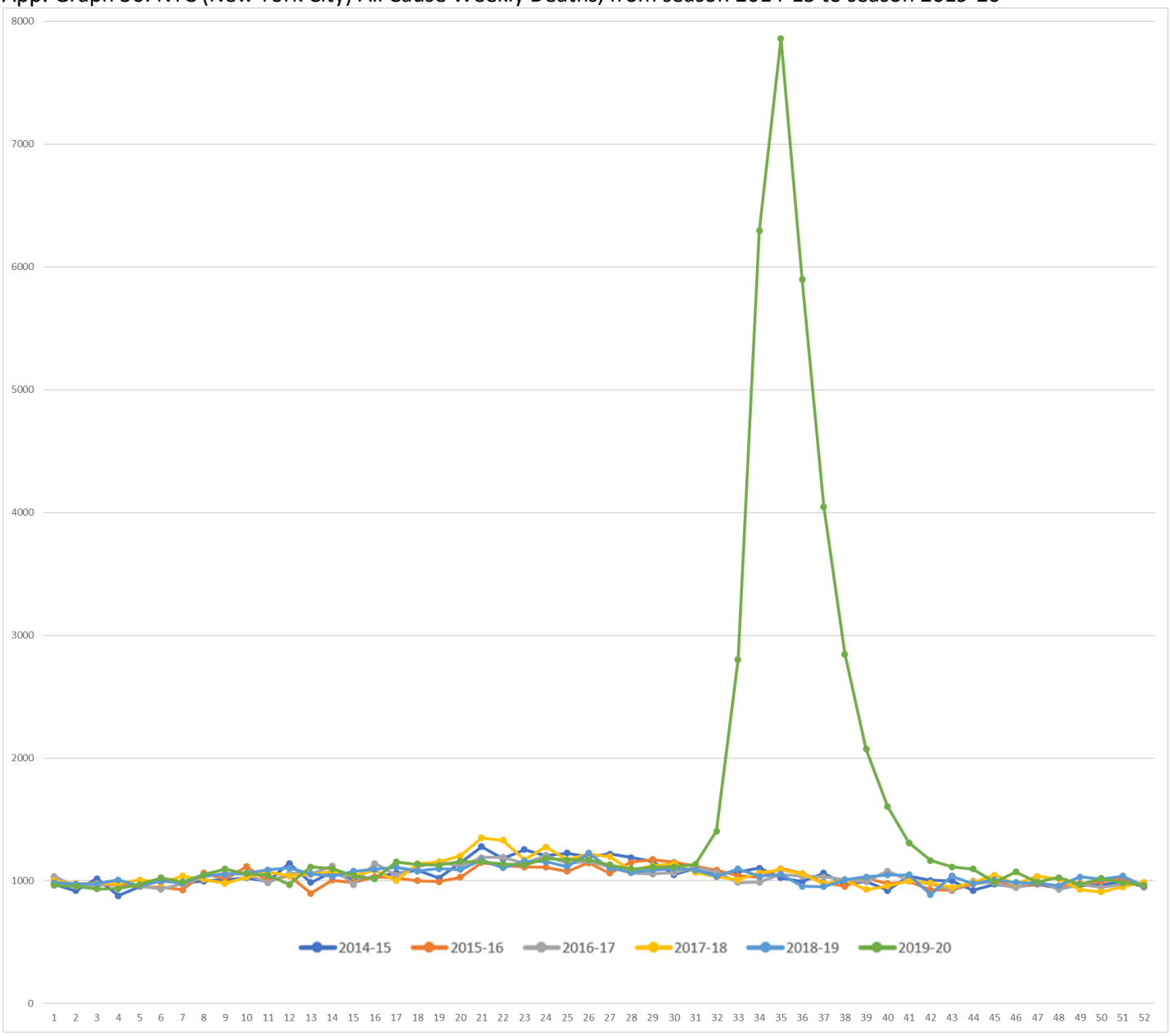
App. Graph 48: NM (New Mexico) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



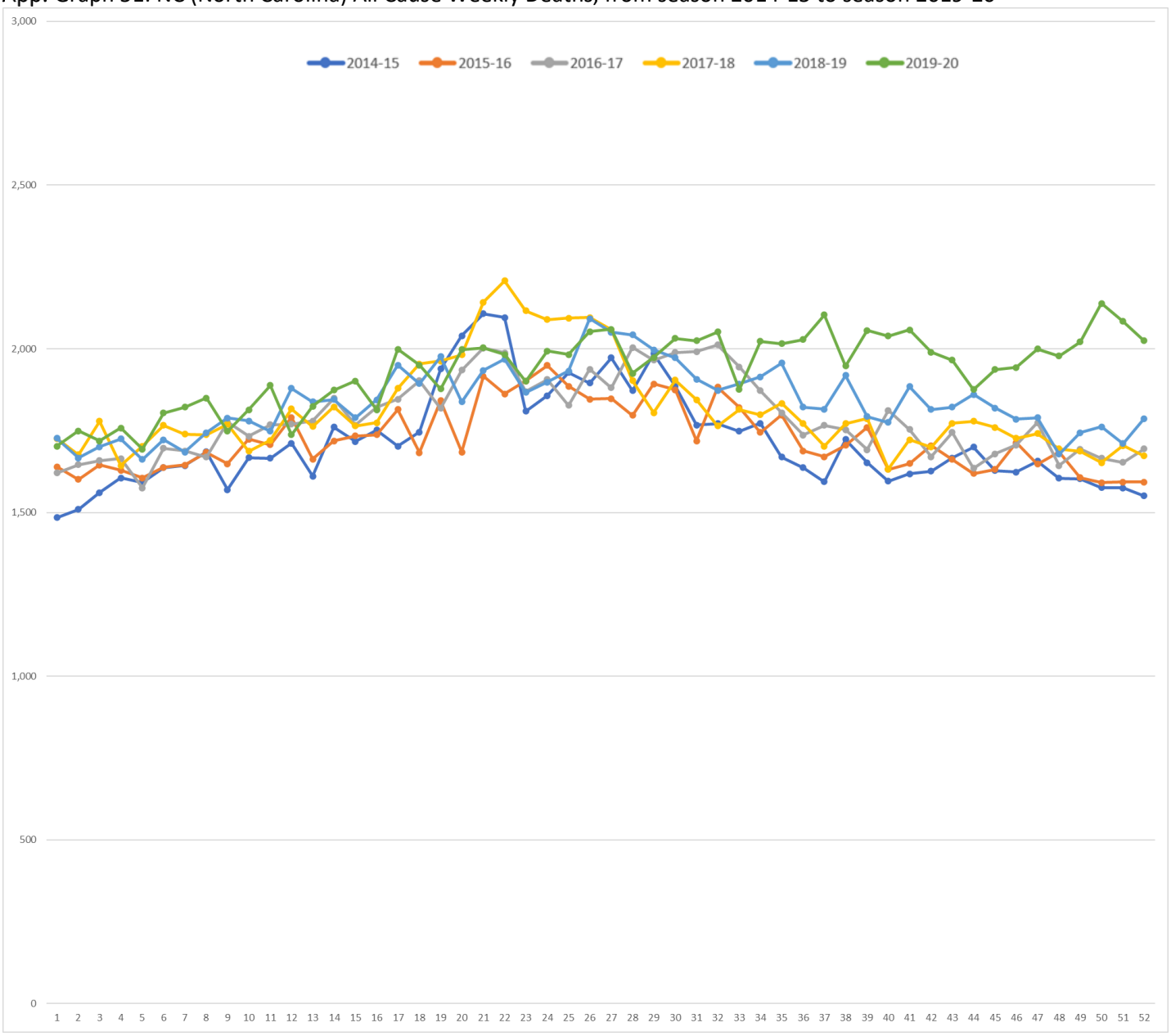
App. Graph 49: NY (New York) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



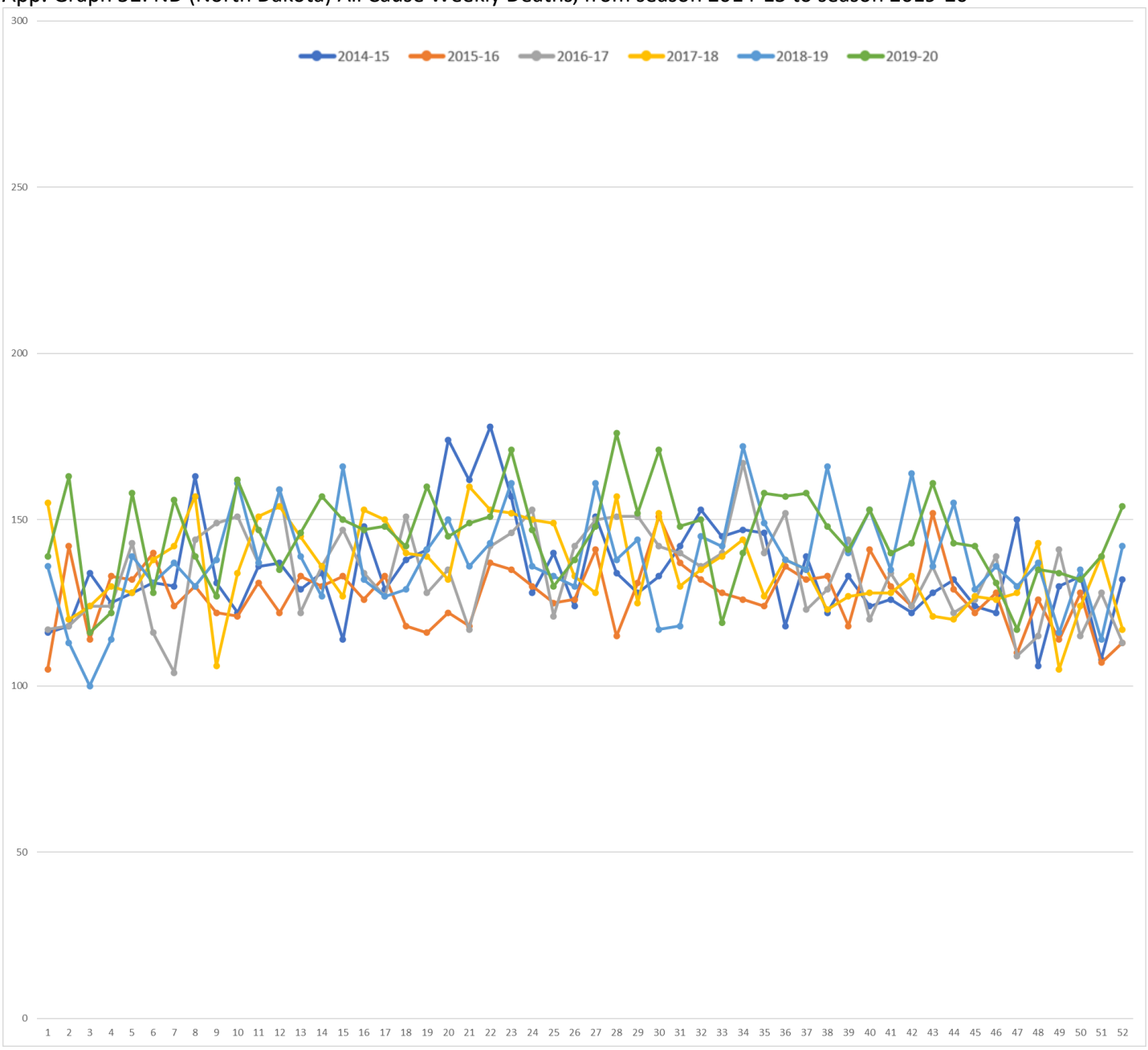
App. Graph 50: NYC (New York City) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



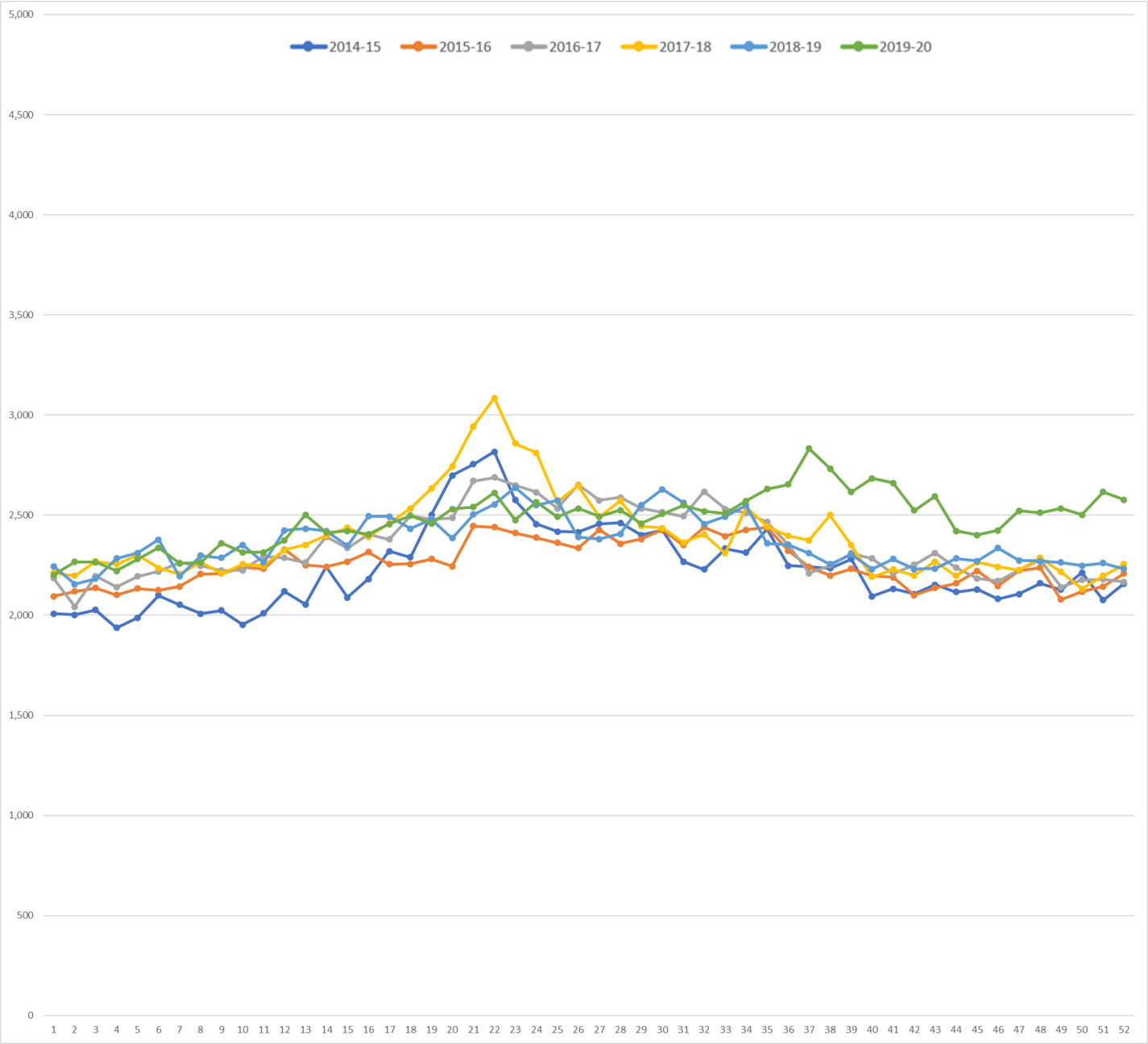
App. Graph 51: NC (North Carolina) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



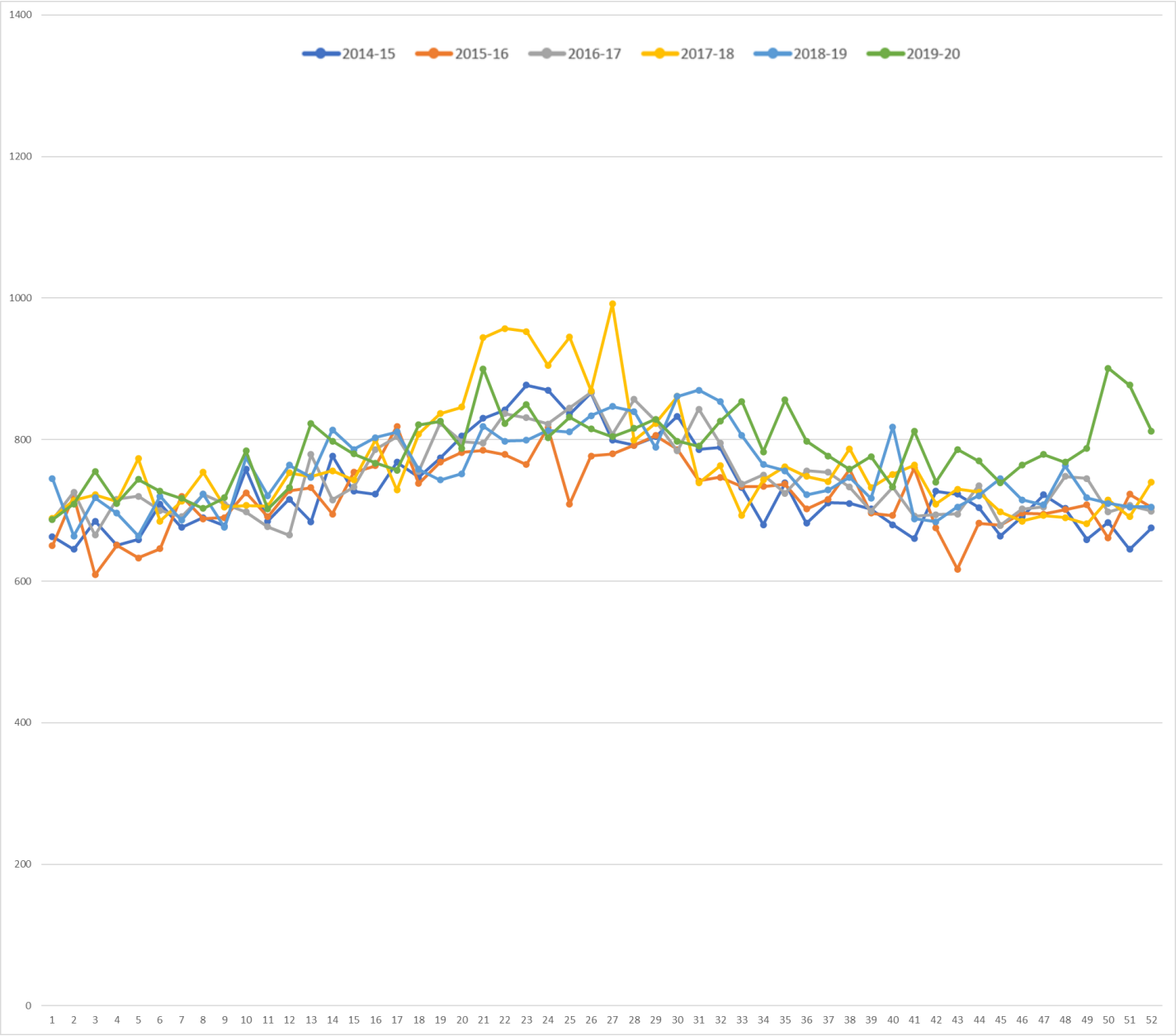
App. Graph 52: ND (North Dakota) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



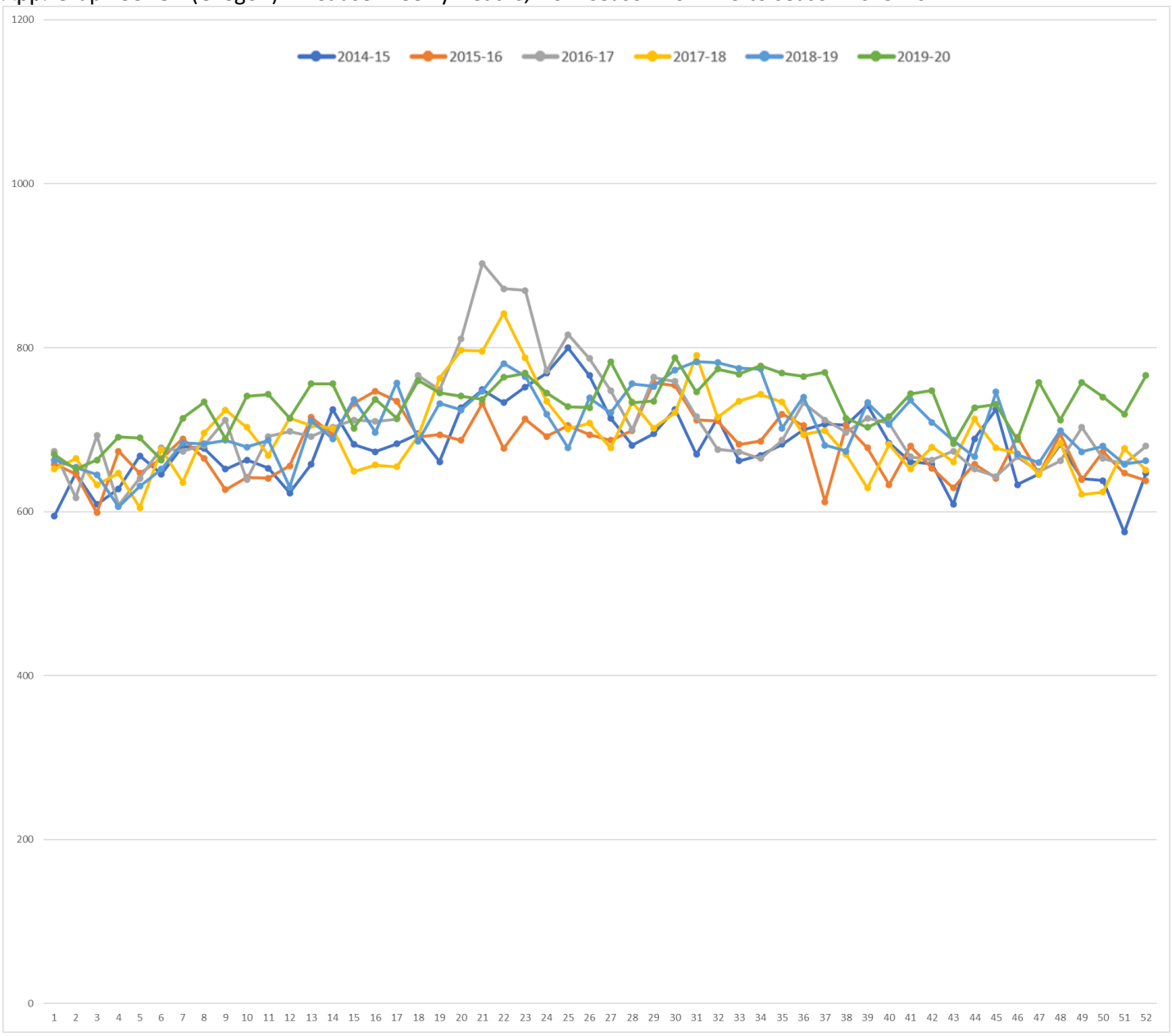
App. Graph 53: OH (Ohio) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



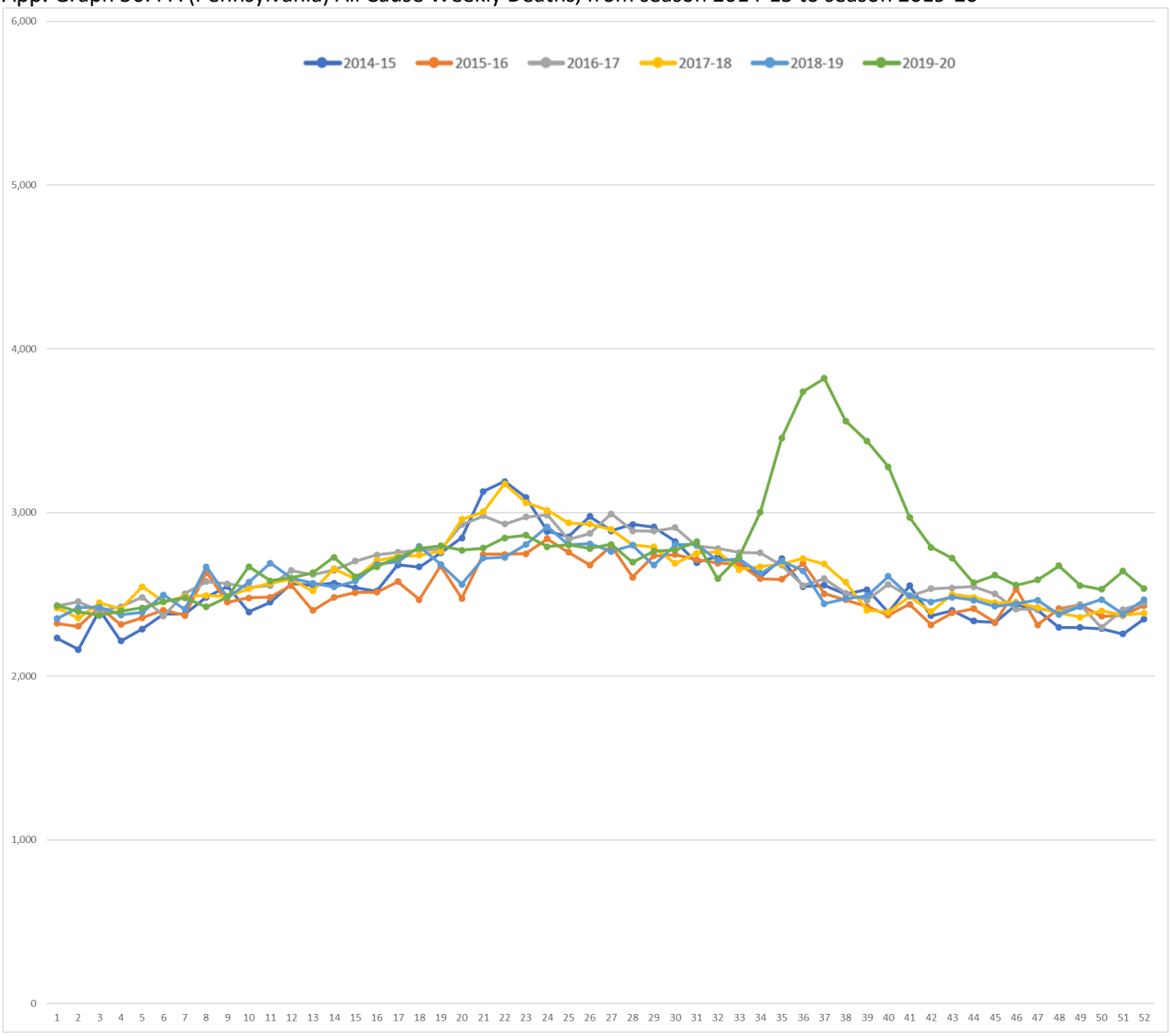
App. Graph 54: OK (Oklahoma) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



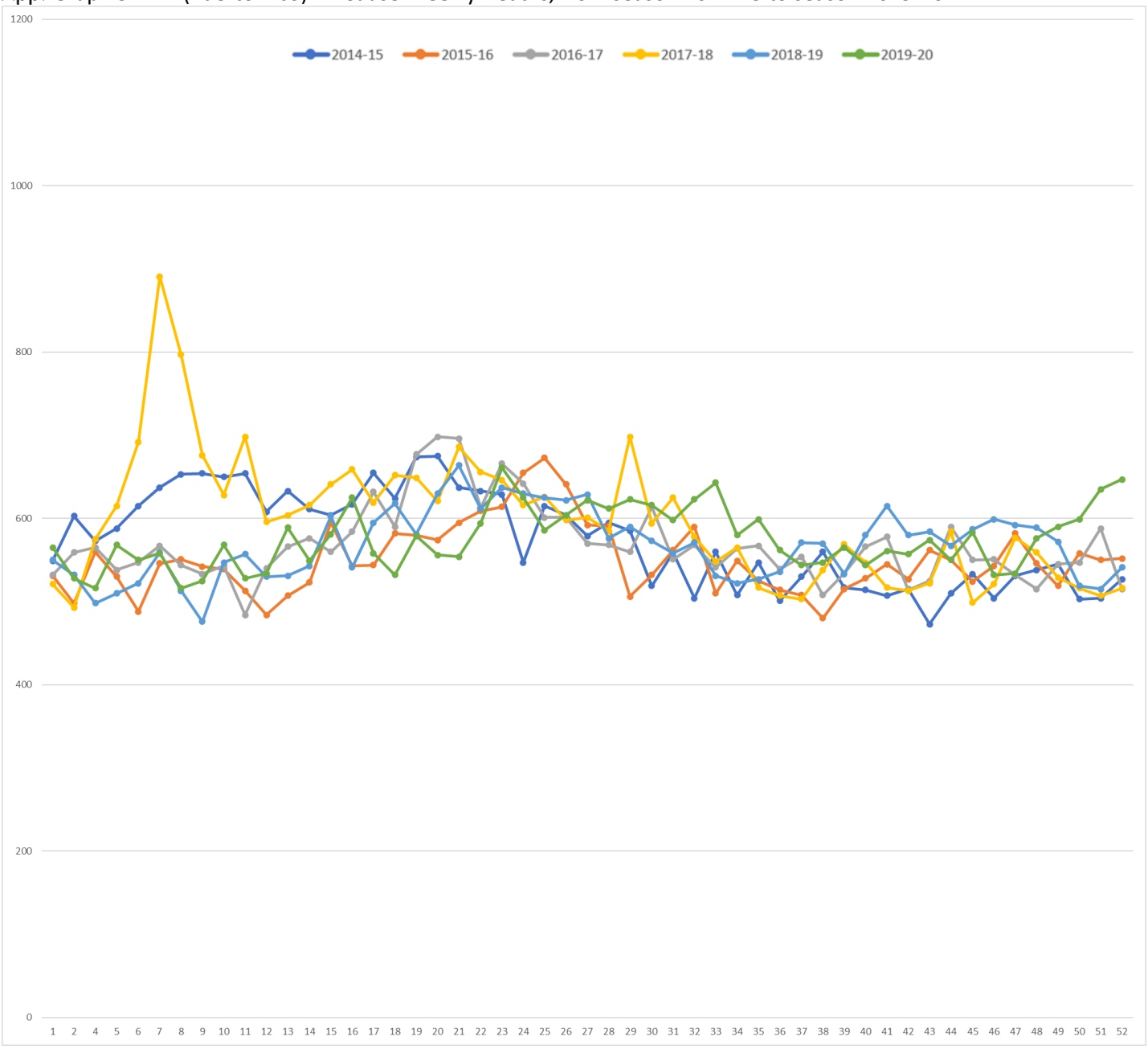
App. Graph 55: OR (Oregon) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



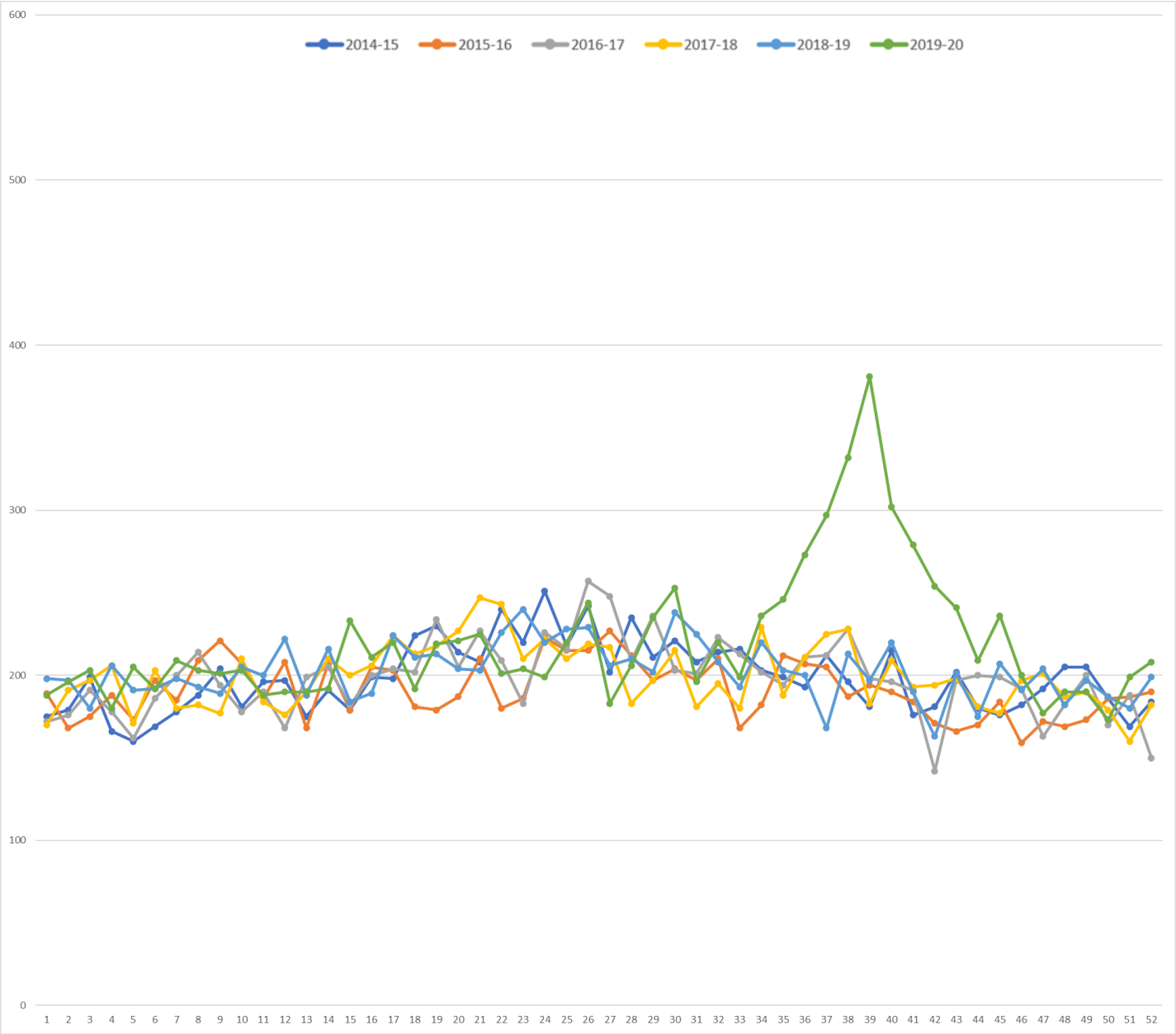
App. Graph 56: PA (Pennsylvania) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



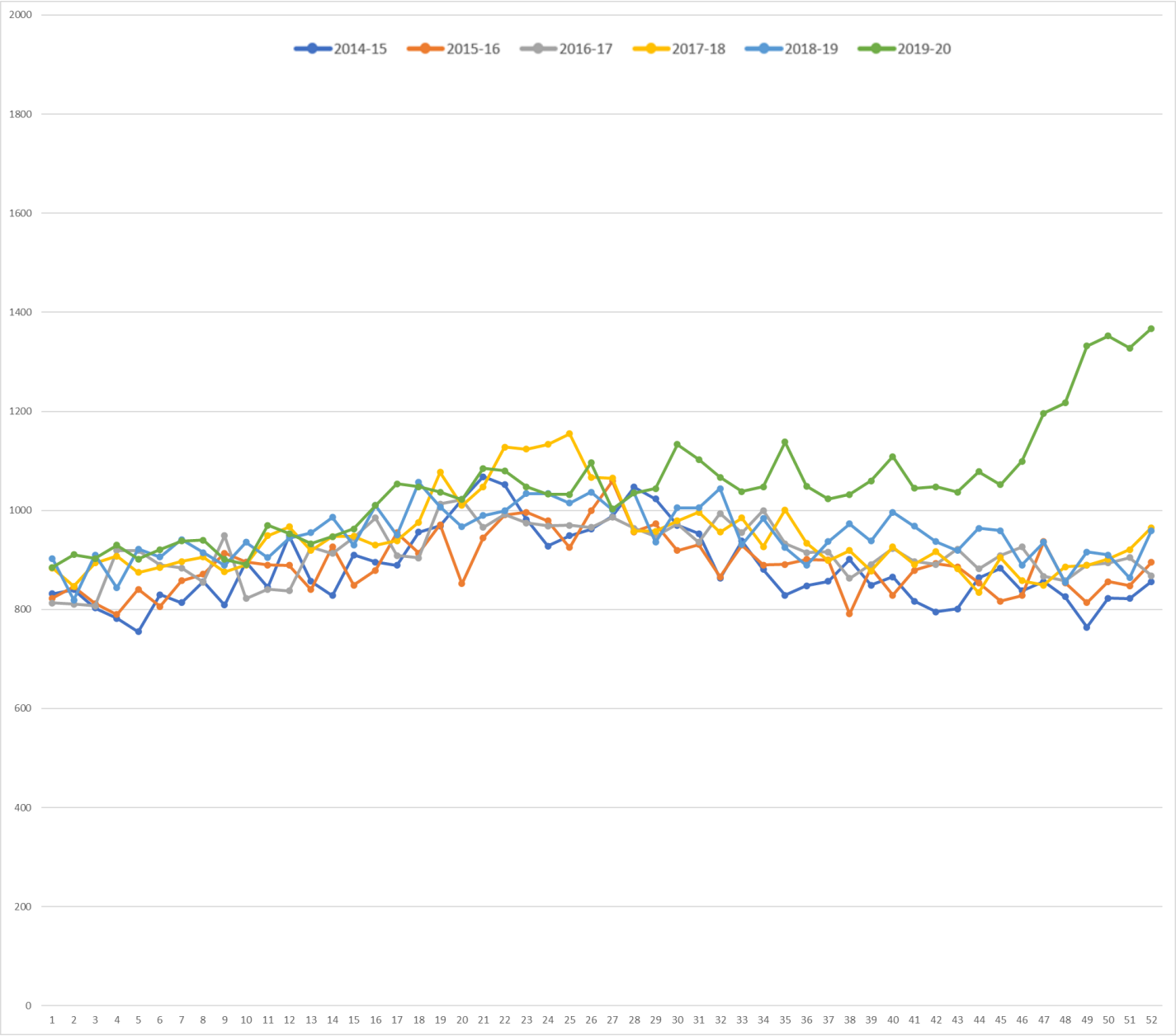
App. Graph 57: PR (Puerto Rico) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



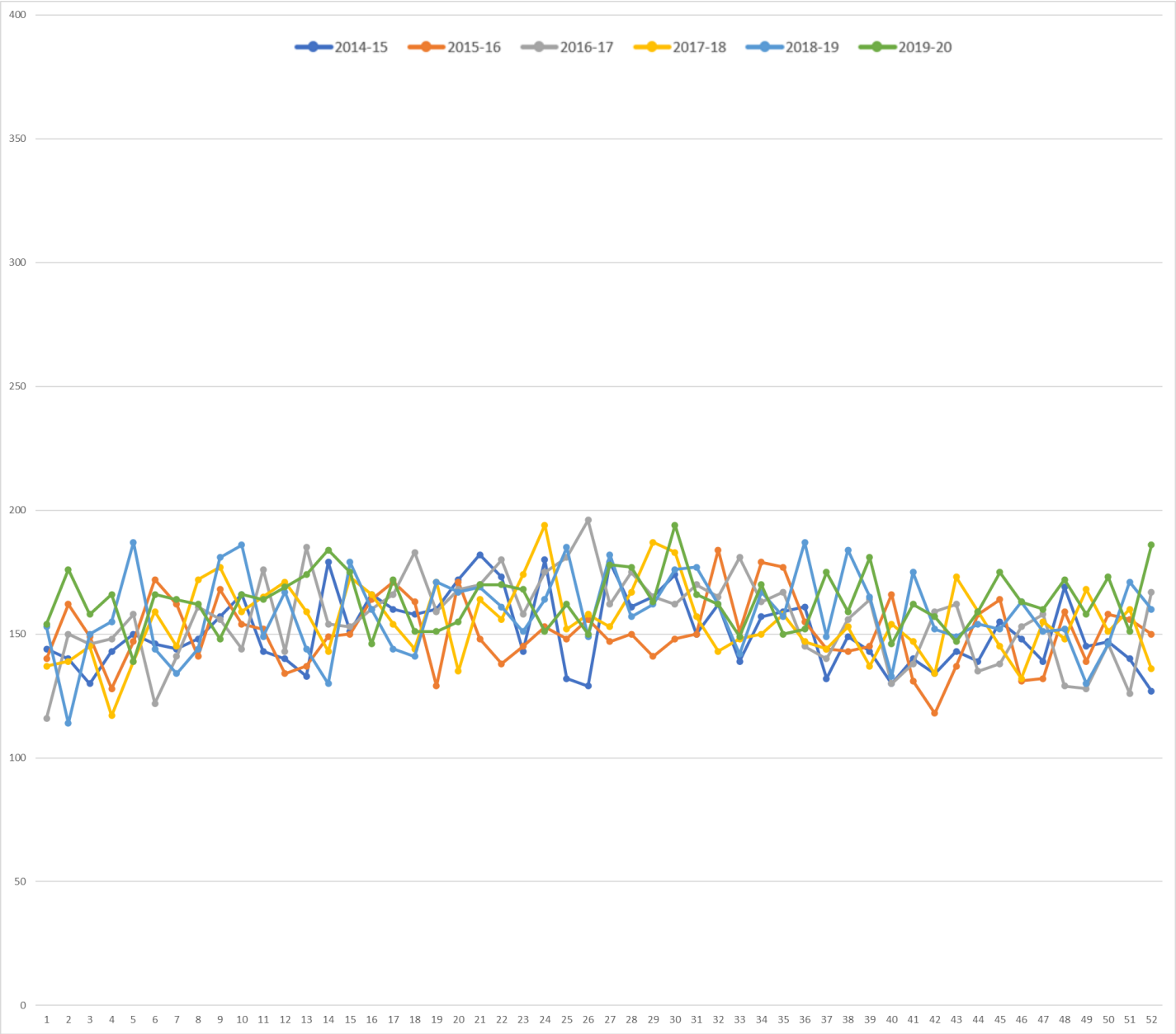
App. Graph 58: RI (Rhode Island) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



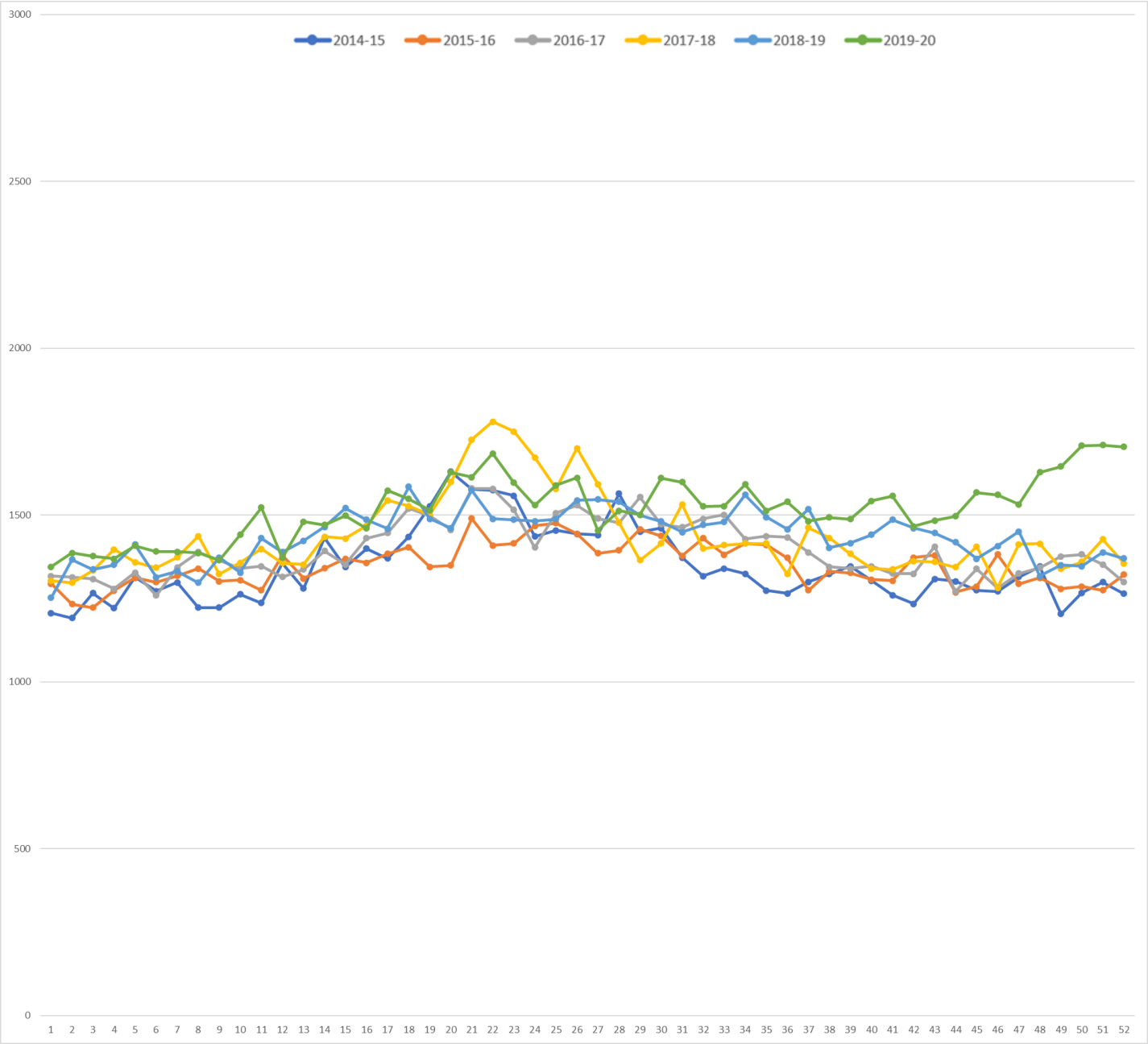
App. Graph 59: SC (South Carolina) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



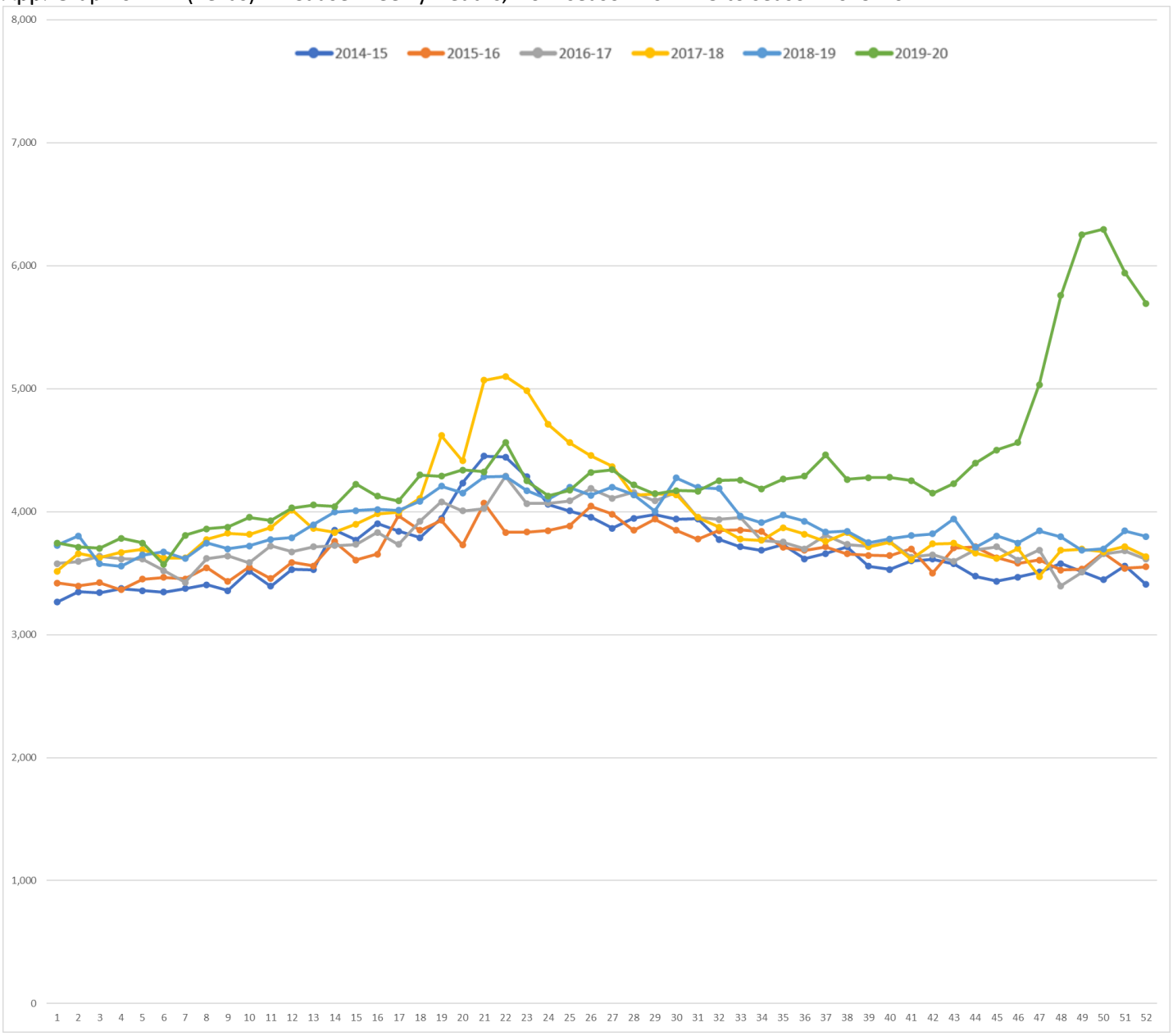
App. Graph 60: SD (South Dakota) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



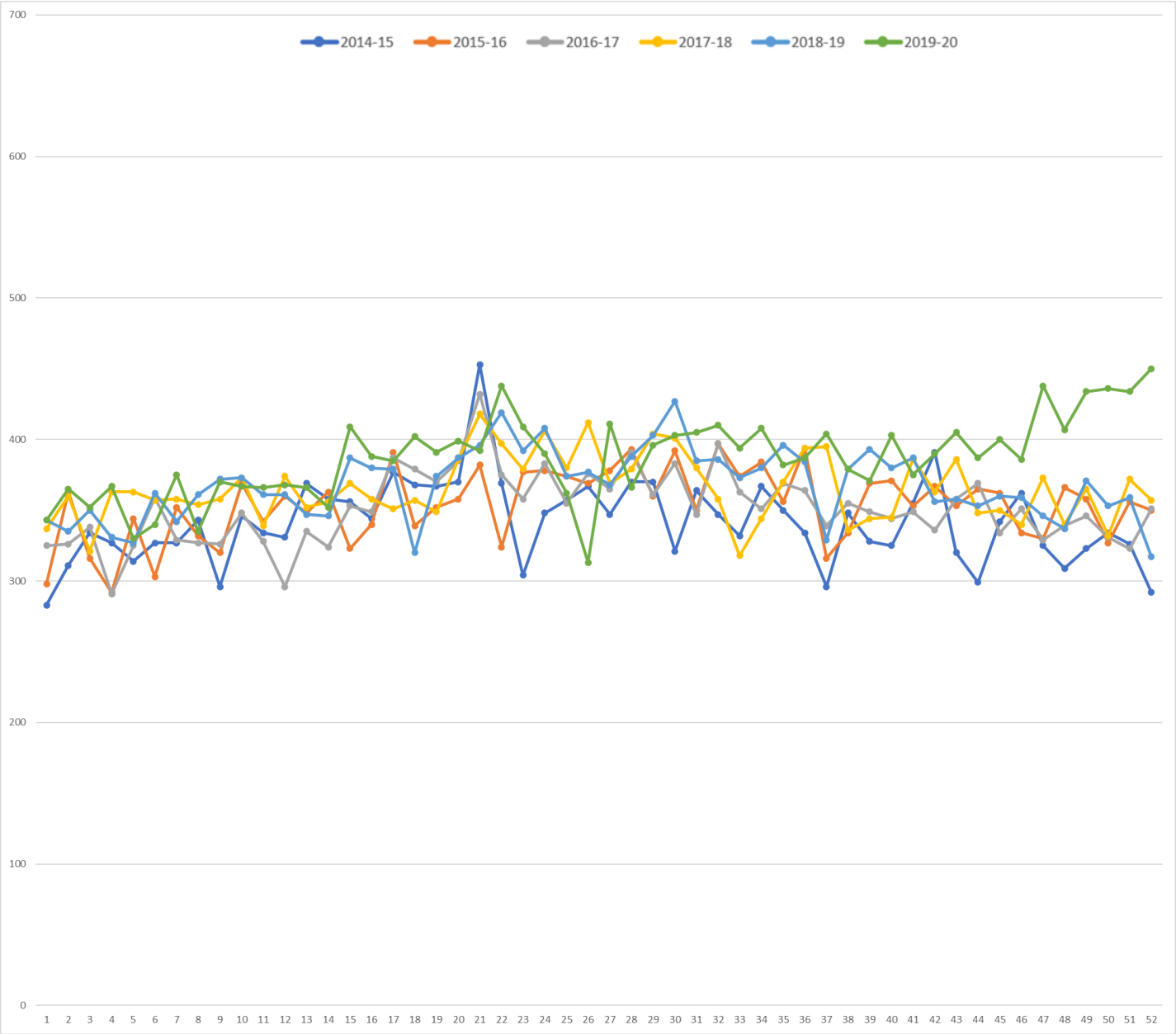
App. Graph 61: TN (Tennessee) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



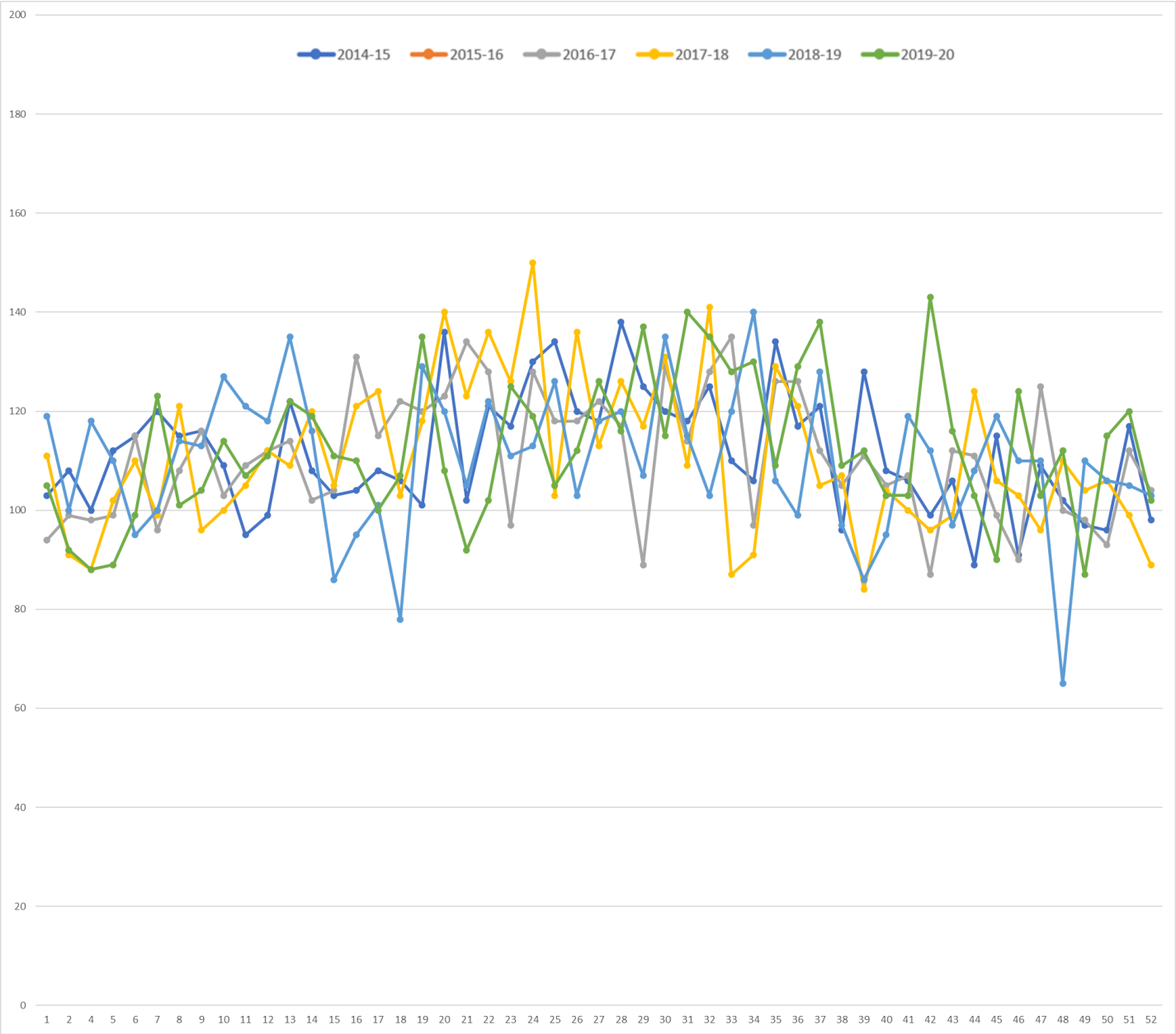
App. Graph 62: TX (Texas) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



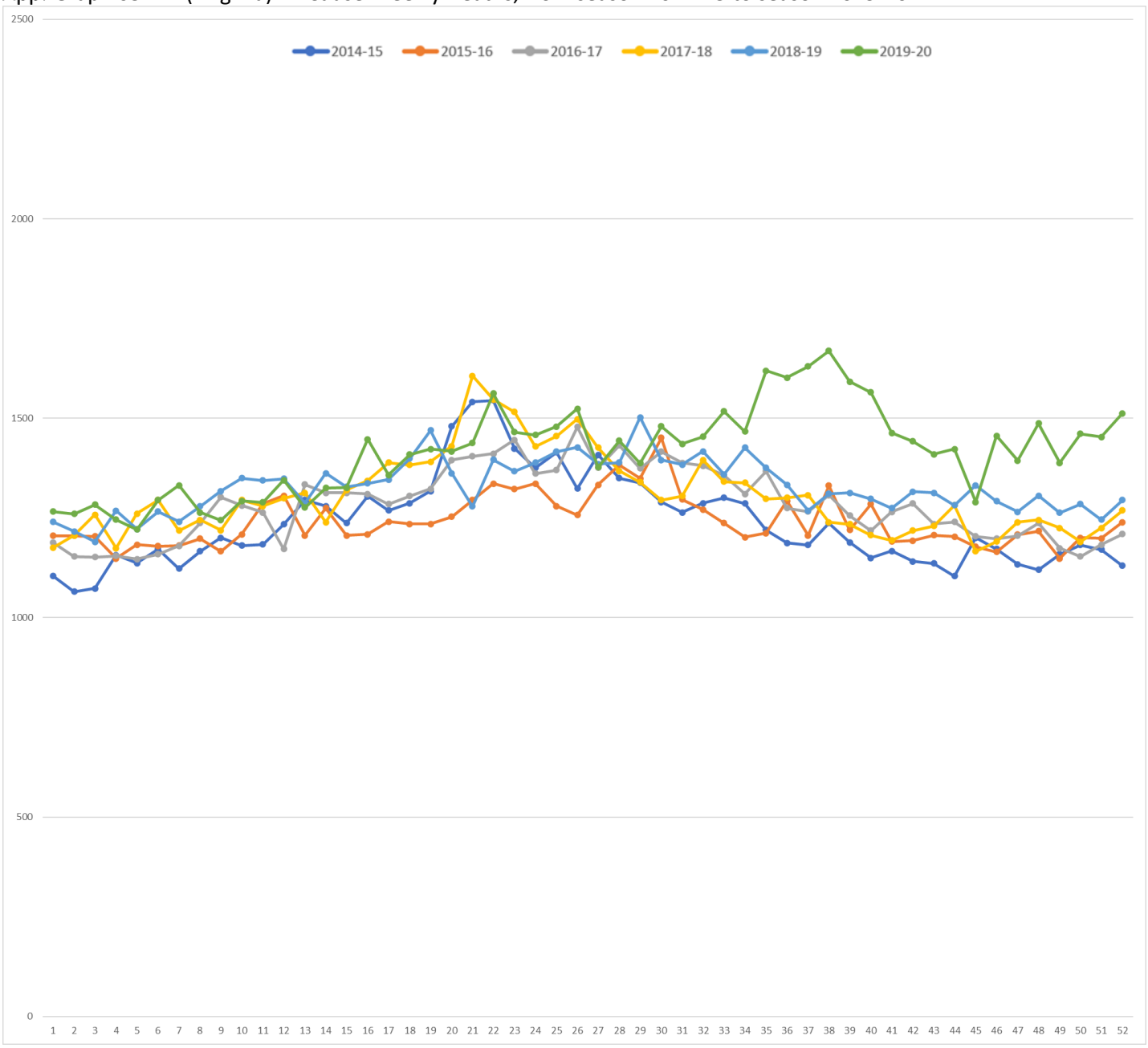
App. Graph 63: UT (Utah) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



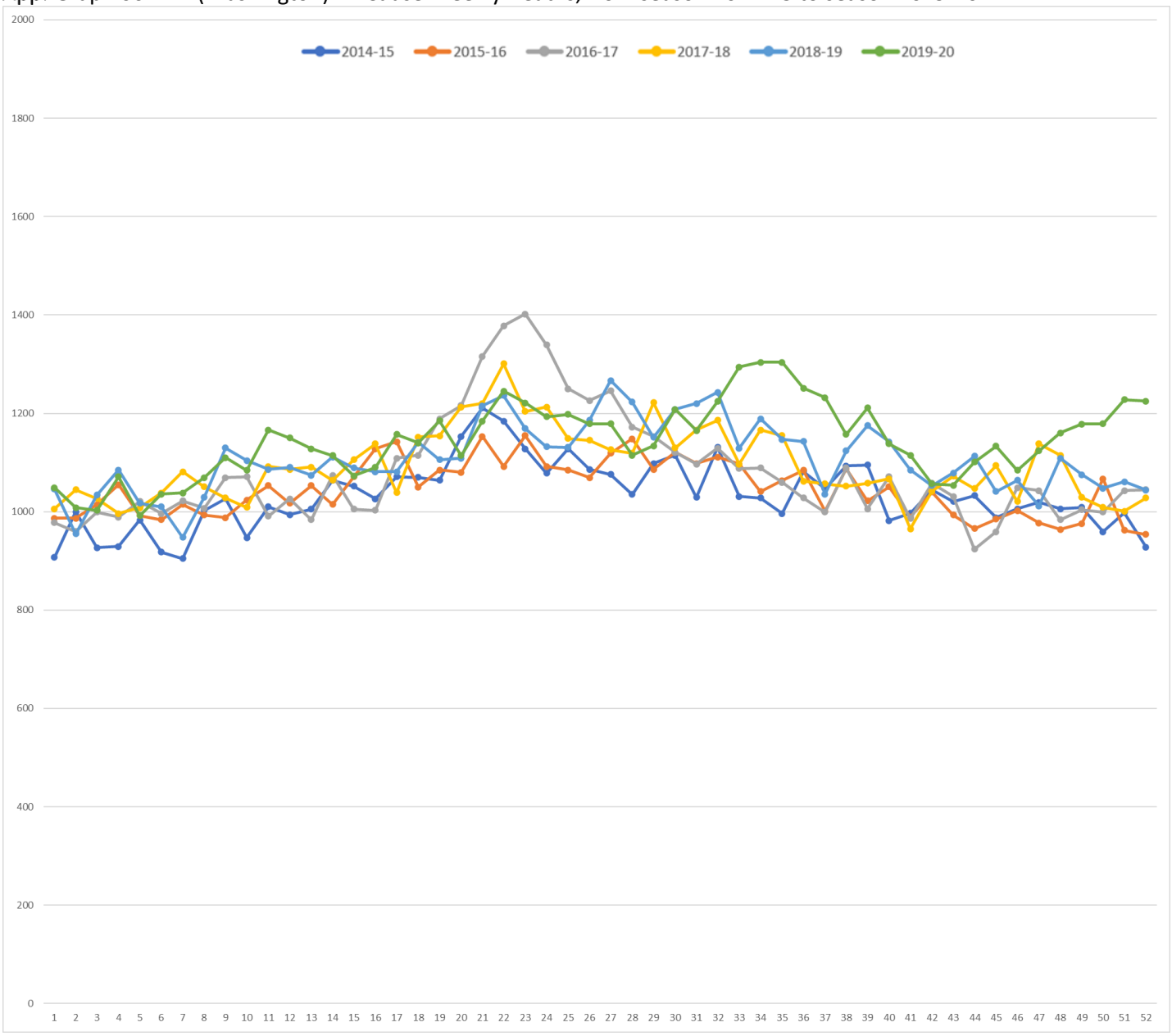
App. Graph 64: VT (Vermont) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



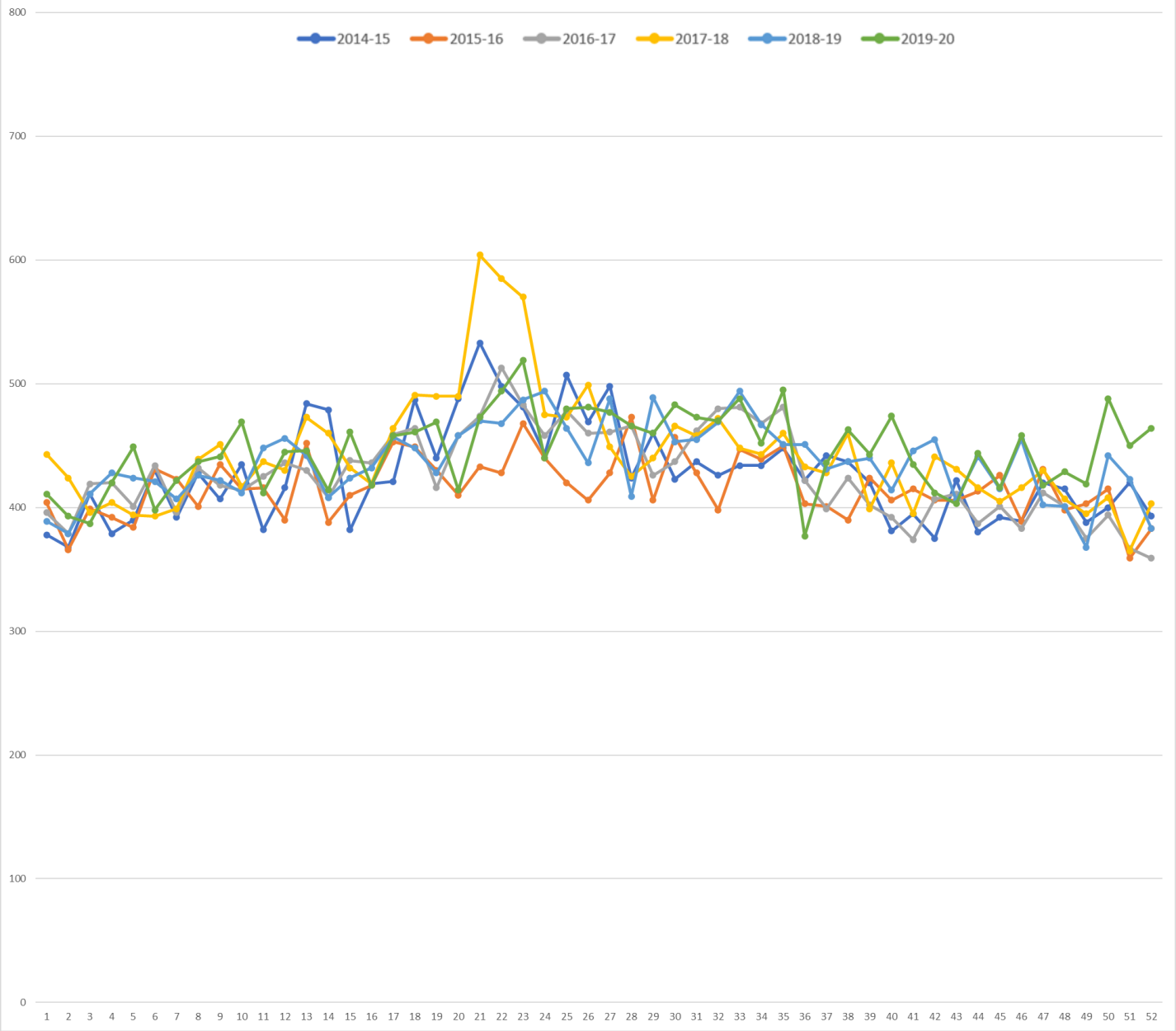
App. Graph 65: VA (Virginia) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



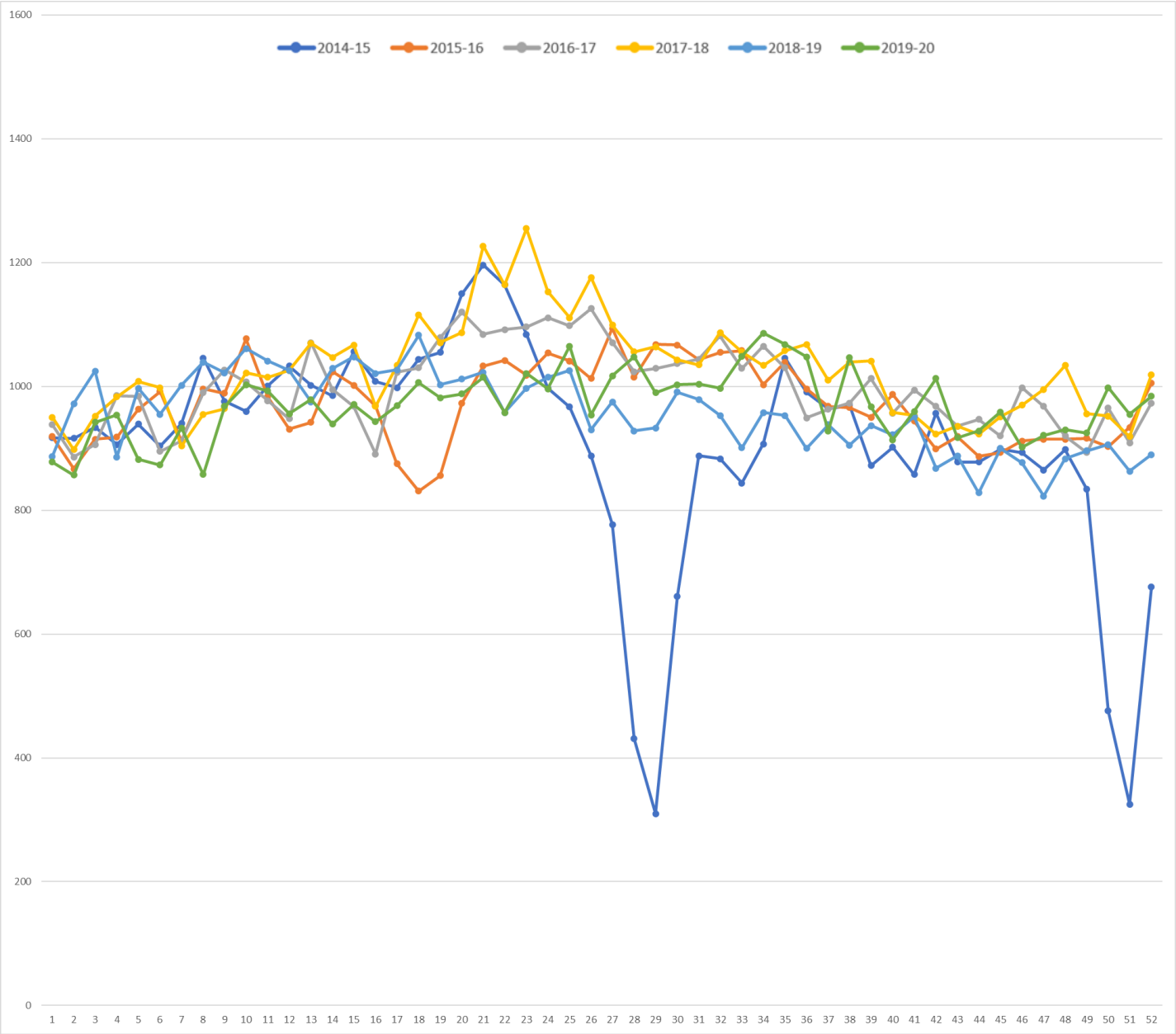
App. Graph 66: WA (Washington) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



App. Graph 67: WV (West Virginia) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



App. Graph 68: WI (Wisconsin) All Cause Weekly Deaths, from season 2014-15 to season 2019-20



App. Graph 69 WY (Wyoming) All Cause Weekly Deaths, from season 2014-15 to season 2019-20