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Perception and Reality: United States Mortality

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ABSTRACT: *Our perception of the world is often taken for granted. There are many theories of perception and often they can appear contradictory. Likely, the various theories are focusing on different aspects of a very complex process. For example, in the fairy tale Little Red Cap (Grimm and Grimm 1909) Little Red's perceptual set fails her when the wolf successfully masquerades as Red's grandmother. Little Red's past experience, emotion and context did not help her make sense of new stimuli which lead to her untimely demise. The purpose of this paper is to tease your perception process, not with fairy tales but by presenting U.S. Mortality counts and context statistics for various years including details for the most recent death season 2019-20. The examination herein provides a timely example of how models of perception conflict with the rich rationality and behavioral literature.*

KEYWORDS: U.S. Crude Death Rates, COVID-19, Context in Perception

INTRODUCTION

Humans hardly see the world as it is. Each one of us form our own unique perception of being. The cognitive psychology literature offers many factors that influence an individual's perceptual hypothesis: emotion, experience, knowledge, motivation, culture, context and expectation (Gregory 1980; 1997, Durie 2005). Individuals then apply this hypothesis to form their own perceptual set. One's perceptual set lends a frame of reference to perceive things in a certain way (Rock 1983). The purpose of this examination is to tease your perception process by presenting U.S. Mortality counts and context statistics for various years including details for the death season 2019 - 20.

DATA

Death counts are based on death certificate data received and coded by the National Center for Health Statistics (NCHS). This data is available to the public through the webpage: http://www.cdc.gov/nchs. Current count data is updated each Wednesday by 5:00 pm EST. According to the NCHS, death certificate counts deliver the most complete and accurate picture of lives lost in the U.S. Archived death certificate data for the years 1999-2019 are available publicly at: http://wonder.cdc.gov. Data used for this paper was download on April 14, 2021.

Population data comes from the Annual Estimates of the Resident Population for the United States, Regions, States, and the District of Columbia; December 2020 Release

(NST-EST2020); U.S. Census Bureau, Population Division. The estimates are based on the 2010 Census and were calculated by the Census Bureau without incorporation or consideration of the 2020 Census results. The 2020 Census data were not available as of the publication date of this paper.

HISTORICAL DEATH RATES

Table 1 depicts the crude U.S. death rate for each calendar year, January 1 through December 31, 1999-2020. The death rate is the simple relation: Deaths by All Causes / U.S. Population, in percentage terms.

Table 1. Death Rates 1999-2020

Calendar Year	Population in Millions	Death Rate
1999	279.0	0.9%
2000	281.4	0.9%
2001	285.0	0.8%
2002	287.6	0.8%
2003	290.1	0.8%
2004	292.8	0.8%
2005	295.5	0.8%
2006	298.4	0.8%
2007	301.2	0.8%
2008	304.1	0.8%
2009	306.8	0.8%
2010	308.7	0.8%
2011	311.6	0.8%
2012	313.9	0.8%
2013	316.1	0.8%
2014	318.4	0.8%
2015	320.7	0.8%
2016	323.1	0.8%
2017	325.1	0.9%
2018	326.8	0.9%
2019	328.3	0.9%
2020	330.8	1.0%

As shown, from 2016 to 2017 the death rate increased 1/10th of 1 percent (0.8% to 0.9%). Similarly, the death rate increased 1/10th of 1 percent from 2019 to 2020 (0.9% to 1.0%). Table 2 shows the crude death rate and associated population proportion for those in the U.S. population age 65 and above (65+). The age 65 and above death rate is the ratio: Deaths by All Causes for those 65+ / Total U.S. Population, in percentage terms. Note that the 65+ death rate increased 2/10ths of 1 percent from 2019 to 2020 (0.6% to 0.8%).

Table 2. Death Rate Age 65 and Above

Calendar Year	65+ Death Rate	% Population 65+
1999	0.6%	12.5%
2000	0.6%	12.4%
2001	0.6%	12.4%
2002	0.6%	12.4%
2003	0.6%	12.4%
2004	0.6%	12.4%
2005	0.6%	12.4%
2006	0.6%	12.5%
2007	0.6%	12.6%
2008	0.6%	12.8%
2009	0.6%	12.9%
2010	0.6%	13.0%
2011	0.6%	13.3%
2012	0.6%	13.7%
2013	0.6%	14.1%
2014	0.6%	14.5%
2015	0.6%	14.9%
2016	0.6%	15.2%
2017	0.6%	15.6%
2018	0.6%	16.0%
2019	0.6%	16.5%
2020	0.8%	16.7%

Table 2, column 3 shows that the U.S. population is getting older. The percent of the U.S. population 65 and above increased from 12.5% in 1999 to 16.7% in 2020.

SEASONAL DEATH

Because deaths in the U.S. follow a certain historical pattern, convention focuses on death seasons rather than calendar years (Briand 2021). Seasonal death years typically start in late October mapping the flu season. Figure 1 depicts weekly death totals from all causes for each 52 week death season beginning November 1, 2014. Weekly data is publicly available from the NCHS for the years 2014 through year to date 2021.

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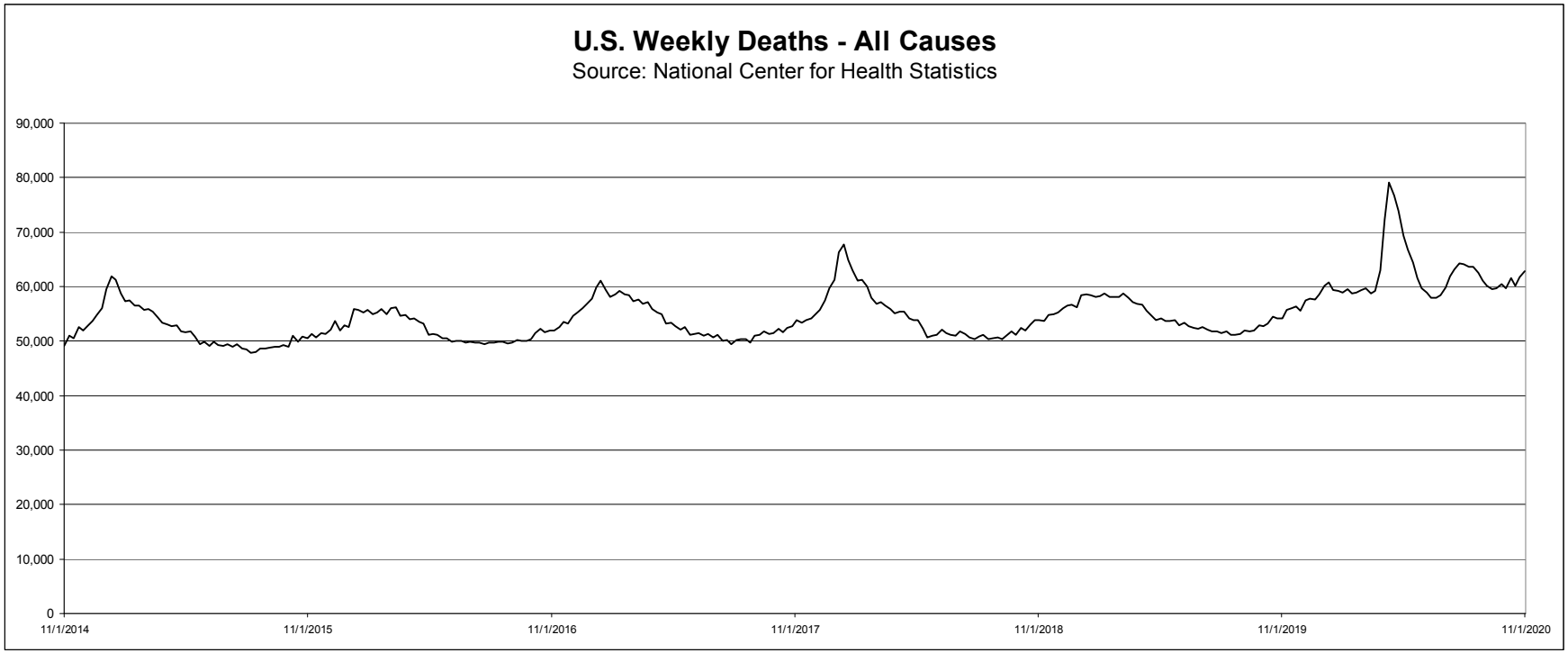
Figure 1. Seasonal Weekly Death Graph



Note that the weekly death peaks occur during the winter and early spring months, year after year. Table 3 shows total deaths from all causes for each 52 week death season.

Table 3. Total Deaths from all Causes

Season	Over the 52 Weeks Ending on		Deaths in Millions
2014-15	11/1/2014	10/24/2015	2.71
2015-16	10/31/2015	10/22/2016	2.71
2016-17	10/29/2016	10/21/2017	2.80
2017-18	10/28/2017	10/20/2018	2.85
2018-19	10/27/2018	10/19/2019	2.84
2019-20	10/26/2019	10/17/2020	3.18

DEATH CATEGORIES

Weekly NCHS data downloads for the years 2014 - 2020 breakdown deaths for the following select categories:

A. Septicemia (includes International Certification of Death (ICD) codes, A40-A41)
B. Malignant neoplasms (C00-C97)
C. Diabetes mellitus (E10-E14)
D. Alzheimer disease (G30)
E. Influenza and pneumonia (J09-J18)
F. Chronic lower respiratory diseases (J40-J47)
G. Other diseases of respiratory system (J00-J06, J30-J39, J67, J70-J98)
H. Nephritis, nephrotic syndrome and nephrosis (N00-N07, N17-N19, N25-N27)
I. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)
J. Diseases of heart (I00-I09, I11, I13, I20-I51)
K. Cerebrovascular diseases (I60-I69)
» COVID-19 (new ICD code adopted March 24, 2020, U07.1, Underlying Cause of Death)

Table 4. Each Category as a Percentage of Total Seasonal Deaths

Season	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	COVID-19
2014-15	1.5%	21.9%	2.9%	4.0%	2.2%	5.7%	1.4%	1.8%	1.2%	23.4%	5.2%	0.0%
2015-16	1.5%	21.9%	2.9%	4.2%	1.9%	5.6%	1.4%	1.8%	1.2%	23.2%	5.2%	0.0%
2016-17	1.5%	21.4%	2.9%	4.3%	1.9%	5.7%	1.5%	1.8%	1.1%	23.0%	5.2%	0.0%
2017-18	1.4%	21.0%	3.0%	4.3%	2.1%	5.6%	1.5%	1.8%	1.1%	23.1%	5.2%	0.0%
2018-19	1.4%	21.1%	3.1%	4.2%	1.7%	5.5%	1.5%	1.8%	1.1%	23.1%	5.2%	0.0%
2019-20	**1.2%**	**18.8%**	**3.1%**	**4.1%**	**1.7%**	**4.8%**	**1.4%**	**1.6%**	**1.2%**	**21.5%**	**4.9%**	**6.3%**

Table 5. Each Category as a Percentage of Total Seasonal Deaths minus COVID-19

Season	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.
2014-15	1.5%	21.9%	2.9%	4.0%	2.2%	5.7%	1.4%	1.8%	1.2%	23.4%	5.2%
2015-16	1.5%	21.9%	2.9%	4.2%	1.9%	5.6%	1.4%	1.8%	1.2%	23.2%	5.2%
2016-17	1.5%	21.4%	2.9%	4.3%	1.9%	5.7%	1.5%	1.8%	1.1%	23.0%	5.2%
2017-18	1.4%	21.0%	3.0%	4.3%	2.1%	5.6%	1.5%	1.8%	1.1%	23.1%	5.2%
2018-19	1.4%	21.1%	3.1%	4.2%	1.7%	5.5%	1.5%	1.8%	1.1%	23.1%	5.2%
2019-20	**1.3%**	**20.1%**	**3.3%**	**4.4%**	**1.8%**	**5.2%**	**1.5%**	**1.8%**	**1.2%**	**23.0%**	**5.2%**

Tables 4 and 5 show deaths in each category as a percentage of total deaths for each 52 week season. Note the uniformity of most category shares over the seasons prior to 2019-20. One exception is column E (Influenza and pneumonia) which exhibits the most variation. Prior to March 24, 2020, officials completing deaths certificates in the U.S. relied on two NCHS sources: Medical Examiners' and Coroners' Handbook on Death Registration and Fetal Death Reporting (2003 Revision) and Physicians' Handbook on Medical Certification of Death (2003 Revision). On March 24, 2020, the NCHS adopted new guidelines and ICD code unique to COVID-19. COVID-19 death data is collected and reported based upon the March 24th Alert No. 2 National Vital Statistics Systems (NVSS) guidelines updated in April 2020, in Report No. 3. Death certificates for all other causes are completed based on the 2003 handbooks.

Adding a new ICD category confounds comparing current death data detail to prior periods. For example, Table 4 shows how the new category distorts the share comparisons for the 2019-20 season. An imperfect concession involves dropping COVID-19 assigned deaths from total deaths (all causes) and recalculating. Table 5 shows the recalculated results. Table 6 contains descriptive statistics and inference from the Table 5 results. Each column series is tested for approximating a normal distribution using the Jarque-Bera statistic. The test fails to reject normality in each applicable series at the 5% level. Calculations performed in Table 6 are intended to show, statistically, any significant divergence regarding the season 2019-20 death assignments. Three categories appear anomalous: B. Malignant neoplasms (C00-C97), C. Diabetes mellitus (E10-E14), and F. Chronic lower respiratory diseases (J40-J47). When differencing the 2019-20 share from the historical mean, each anomalous category falls three standard deviations or more (plus or minus) beyond the historical mean. The probability of this occurring, regardless of the distribution, is small. Two categories, Malignant neoplasms and Chronic lower respiratory disease appear significantly undercounted when compared to historical shares.

Table 6. Descriptive Statistics and Inference
(nd - not defined)

	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.
Mean, Seasons 2014-15 to 2018-19	1.5%	21.5%	3.0%	4.2%	2.0%	5.6%	1.5%	1.8%	1.1%	23.2%	5.2%
Standard Deviation (STD)	0.1%	0.4%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%
Season 2019-20 minus Mean (DIF)	-0.2%	-1.4%	0.3%	0.2%	-0.2%	-0.4%	0.0%	0.0%	0.1%	-0.2%	0.0%
Number of STD DIF is (+) or (-) from the Mean	-2.0	-3.5	3.0	2.0	-1.0	-4.0	0.0	nd	1.0	-2.0	nd
Jarque-Bera (Chi Sq, 2 df) Ho: Approx. Normal	1.7	5.6	2.2	1.9	5.0	1.5	5.7		3.8	1.9	

Table 7. Regional Death Share
Change in Total Deaths from 2018-19 to 2019-20 Season, in Thousands

California			50.5			
New York			45.3			
Pennsylvania			22.5			
New Jersey			20.5			
Illinois			19.7			
Michigan			16.4			
Massachusetts			15.3	190.2	55.9%	of the Change in Total Deaths
United States				340.3		

REGIONAL ANALYSIS

Table 3 shows the difference in total deaths from season 2018-19 to 2019-20 - roughly 340 thousand. Table 7 depicts states that make up large shares of this difference. The seven states listed make up roughly 56% of the total season to season wedge. Two states, California and New York make up 28% of the change. Each state listed adhered to austere COVID-19 protocols.

FINAL THOUGHTS

The 2019-20 seasonal death counts, arguably, captured more public attention than any mortality data in recent history. Accordingly, the examination herein provides a timely example of how models of perception conflict with the rationality and behavioral literature. Noted Nobel Laureate, Daniel Kahneman, argues that "the behavior of agents is not guided by what they are able to compute" rather "by what they happen to see at a given moment" (Kahneman 2003). The discrepancy between what is seen (or reported) and in fact what is there, forms the basis of irrationality and highlights the limits of perception processes (Kahneman 2011). Remember, in Charles Perrault's version of Little Red, there was not a happy ending (Opie and Opie 1980).

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