



ARTICLE

The Prevalence of Underlying Health Conditions Among COVID-19 Deaths

An Applied Biostatistician's Perspective

On March 11, 2020, the World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic.¹ A month later, a total of 1,610,909 confirmed COVID-19 cases and 99,690 deaths were reported worldwide.² These figures can be difficult to comprehend as a health crisis of this magnitude and significance is unprecedented. It is even more challenging to understand how these numbers relate to oneself: What is my risk? How likely am I to experience a severe case that results in death?

Reports from China, Italy and the Centers for Disease Control and Prevention suggest that risk factors for severe disease include advanced age and the presence of at least one of several underlying health conditions.^{3,4,5} To better understand the relationship of these risk factors to COVID-19 deaths, we gathered and analyzed data published by the New York City Department of Health and Mental Hygiene describing underlying health conditions among COVID-19 deaths in New York City.

Analysis & Findings

As defined by the New York City Department of Health and Mental Hygiene (NYC DOH), underlying health conditions that are risk factors for severe disease include diabetes, lung disease, cancer, immunodeficiency, heart

disease, hypertension, asthma, kidney disease, and GI/liver disease.⁶

As of April 11, 2020, there were 5,742 COVID-19 deaths in New York City, as shown in Figure 1.⁷ Of the 5,742 deceased patients, 4,407 had underlying conditions, and 118 had no underlying conditions.⁸ NYC DOH listed 1,217 deceased patients in the “Underlying Conditions Unknown” category, indicating that it was still trying to determine whether the person had any underlying conditions at the time of the data was released.⁹

Figure 1 – NYC DOH COVID-19 REPORTED DEATHS

	Underlying Conditions	No Underlying Conditions	Underlying Conditions Unknown	Total
Age Group				
0 to 17	3 (100%)	0 (0%)	0 (0%)	3 (100%)
18 to 44	213 (79%)	24 (9%)	33 (12%)	270 (100%)
45 to 64	1134 (84%)	50 (4%)	173 (13%)	1357 (100%)
65 to 74	1113 (79%)	21 (1%)	281 (20%)	1415 (100%)
75 and over	1944 (72%)	23 (1%)	730 (27%)	2697 (100%)
Sex				
Female	1591 (76%)	26 (1%)	476 (23%)	2093 (100%)
Male	2624 (76%)	88 (3%)	721 (21%)	3433 (100%)
Unknown	192 (89%)	4 (2%)	20 (9%)	216 (100%)
Borough				
Bronx	1199 (92%)	11 (1%)	98 (7%)	1308 (100%)
Brooklyn	1130 (70%)	44 (3%)	444 (27%)	1618 (100%)
Manhattan	465 (70%)	18 (3%)	179 (27%)	662 (100%)
Queens	1386 (75%)	42 (2%)	420 (23%)	1848 (100%)
Staten Island	226 (74%)	3 (1%)	76 (25%)	305 (100%)
Unknown	1 (100%)	0 (0%)	0 (0%)	1 (100%)
Total	4407 (77%)	118 (2%)	1217 (21%)	5742 (100%)

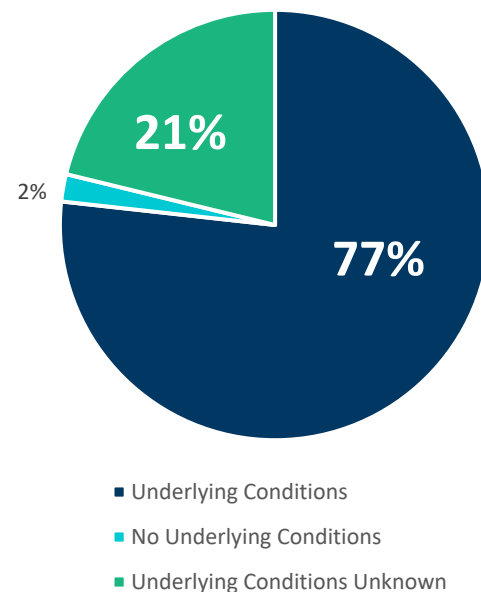
In looking at the table above, most people would tend to find where they fall in the different rows on the left and then scroll right to see the relevant statistics for that demographic. However, the primary differentiator for all demographics is whether an individual had an underlying condition. For example, for people between the ages of 65 and 74, the number of people who died from COVID-19, who have no underlying conditions, is less than 2%

(21/1113) of the people who died with underlying conditions.

Comparing the total deceased patient counts in the “Underlying Conditions”, the “Underlying Conditions Unknown”, and the “No Underlying Conditions” categories based on data provided by NYC DOH, we found that:

- **77%** of the COVID-19 deaths are patients in the “**Underlying Conditions**” category;
- **21%** of the COVID-19 deaths are patients in the “**Underlying Conditions Unknown**” category; and
- **2%** of the COVID-19 deaths are patients in the “**No Underlying Conditions**” category.

Figure 2 – NYC COVID-19 DEATHS BY CONDITION

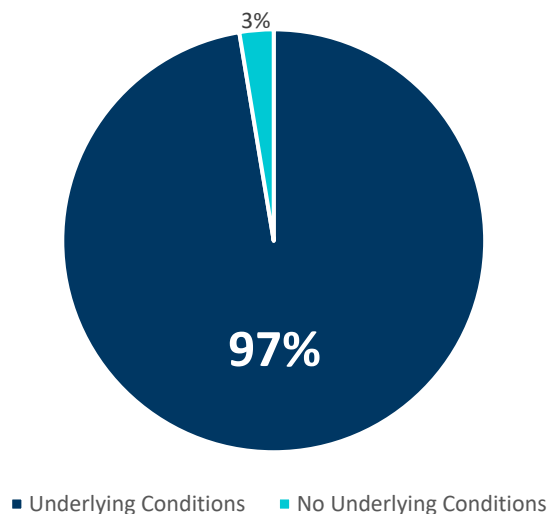


However, the primary differentiator for all demographics is whether an individual had an underlying condition.

If we look at the two groups for whom NYC DOH has underlying conditions data¹⁰ as of April 11, 2020, and compare deceased patients in the “Underlying Conditions” category to those in the “No Underlying Conditions” category, we found that:

- **97%** of the COVID-19 deaths are patients in the “**Underlying Conditions**” category, whereas
- **3%** of the COVID-19 deaths are patients in the “**No Underlying Conditions**” category.

Figure 3 – NYC COVID-19 DEATHS BY KNOWN UNDERLYING CONDITIONS

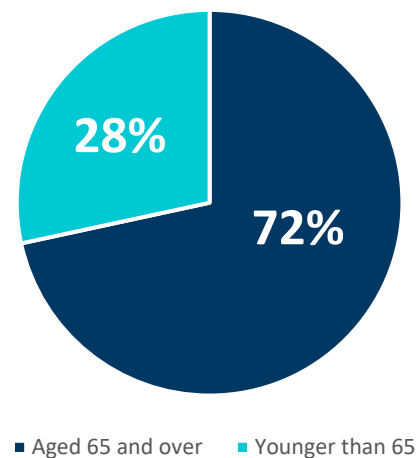


Another common metric reported for COVID-19 cases in New York City is the case fatality rate or “CFR,” which is the proportion of deaths related to COVID-19 compared to the total number of people diagnosed with the disease. As of April 11, NYC DOH reported 5,742 deaths involving 98,715 diagnosed cases for an overall case fatality rate of 5.8% (5,742/98,715).¹¹ The deaths of patients with underlying conditions were 4.5% of all diagnosed cases (4,407/98,715), and the deaths of patients with no underlying conditions were 0.1% (118/98,715) of all diagnosed cases.

While comparing deceased patient counts in different age groups, we found that:

- **72%** of the COVID-19 deaths are patients who were **aged 65 or over**, whereas
- **28%** of the COVID-19 deaths are patients who were **younger than 65**.

Figure 4 – NYC COVID-19 DEATHS BY AGE GROUP



Deceased patients who were aged 65 or over, and in the “Underlying Conditions” category account for 53% of the total deaths. Moreover, if we look at deaths in the two groups for whom NYC DOH has underlying conditions data¹² as of April 11, 2020, deceased patients who were aged 65 or over, and in the “Underlying Conditions” category, account for 68% of the total deaths.

The deaths of patients with underlying conditions were 4.5% of all diagnosed cases, and the deaths of patients with no underlying conditions were 0.1% of all diagnosed cases.

These findings that those who die of COVID-19 are disproportionately those with pre-existing health conditions and/or are aged 65 or older are consistent with reports from the New York State Department of Health and the Centers for Disease Control and Prevention. As of April 11, 2020, the New York State Department of Health reported that 88.0% of total COVID-19 fatalities have at least one comorbidity.¹³ The top five comorbidities listed by the New York State Department of Health are: hypertension (56%), diabetes (37.2%), hyperlipidemia (19.7%), coronary artery disease (12.1%), and dementia (10.4%).¹⁴

A study published by the Centers for Disease Control and Prevention on April 8, 2020, states that during March 1 – 30, for approximately 12.1% of COVID-19 hospitalized adults in 99 counties in 14 states, 89.3% had one or more underlying conditions. The most commonly reported were hypertension (49.7%), obesity (48.3%), chronic lung disease (34.6%), diabetes mellitus (28.3%), and cardiovascular disease (27.8%).¹⁵

Discussion

Among the 5,742 New York City COVID-19 deaths reported by New York City Department of Health and Mental Hygiene as of April 11, 2020, at least 77% (and likely much higher after unknown underlying conditions are determined) of the infected patients had data available pertaining to underlying health conditions. This result is consistent with findings from the New York State Department of Health and the Centers for Disease Control and Prevention, which suggest that 88.0% of fatalities in NY State are of patients with underlying health conditions. This analysis was limited by small numbers and missing data because of the burden placed on reporting health departments with rapidly rising case counts, and these findings may change as additional data become available.

As states look to the future and consider reopening local economies, these findings may be valuable for politicians, lawmakers and businesses' planning and decisionmaking. Understanding which groups of people are most at risk during this pandemic may be helpful in the transition to more targeted public health care guidelines, allowing part of society to return to "normal."

¹ World Health Organization. WHO Director-General’s opening remarks at the media briefing on COVID-19—11 March 2020. Geneva, Switzerland: World Health Organization; 2020.

<https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>

² World Health Organization. Coronavirus disease 2019 (COVID-19) situation report – 82. Geneva, Switzerland: World Health Organization; 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200411-sitrep-82-covid-19.pdf?sfvrsn=74a5d15_2

³ Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China.

<https://www.nejm.org/doi/full/10.1056/NEJMoa2002032>

⁴ COVID-19 Surveillance Group. Characteristics of COVID-19 patients dying in Italy: report based on available data on March 20th, 2020. Rome, Italy: Istituto Superiore Di Sanita; 2020.

https://www.epicentro.iss.it/coronavirus/bollettino/Report-COVID-2019_20_marzo_eng.pdf

⁵ Centers for Disease Control and Prevention. Preliminary Estimates of the Prevalence of Selected Underlying Health Conditions Among Patients with Coronavirus Disease 2019 — United States, February 12–March 28, 2020.

<https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6913e2-H.pdf>

⁶ New York City Department of Health and Mental Hygiene. Coronavirus Disease 2019 (COVID-19) Daily Data Summary.

<https://www1.nyc.gov/assets/doh/downloads/pdf/imm/covid-19-daily-data-summary-deaths-04112020-2.pdf>

⁷ *Ibid.* The percentages in each row represent the percentages of corresponding categories “Underlying Conditions”, “No Underlying Conditions” and “Underlying Conditions Unknown” compared to “Total”. These percentages are calculated by the authors.

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ This comparison makes the simplifying assumption that the patients in the “Underlying Conditions Unknown” category will eventually be categorized into the groups of “Underlying Conditions” and “No Conditions” with the same proportions as currently being observed.

¹¹ New York City Department of Health and Mental Hygiene. Cases, Hospitalizations and Deaths.

<https://www1.nyc.gov/site/doh/covid/covid-19-data.page>

¹² This comparison makes the simplifying assumption that the patients in the “Underlying Conditions Unknown” category will eventually be categorized into the groups of “Underlying Conditions” and “No Conditions” with the same proportions as currently being observed.

¹³ New York State Department of Health. COVID-19 Tracker.

<https://covid19tracker.health.ny.gov/views/NYS-COVID19-Tracker/NYSDOHCOVID-19Tracker-Fatalities?%3Aembed=yes&%3Atoolbar=no&%3Atabs=n>

¹⁴ *Ibid.*

¹⁵ Centers for Disease Control and Prevention. Hospitalization Rates and Characteristics of Patients Hospitalized with Laboratory-Confirmed Coronavirus Disease 2019 — COVID-NET, 14 States, March 1–30, 2020.

<https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e3.htm>

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