Identification of Deaths Caused by Cancer and COVID-19 in the US During March to December 2020

Persons with cancer have high risks of COVID-19 infection and death, especially in 2020, when vaccines were not available.1 Cancer care was disrupted, particularly among patients with socioeconomic disadvantages.2,3 Although research using data from electronic health records and medical claims evaluated the adverse effects of the pandemic in cancer care and outcomes, there are limited data on the excess death burden associated with the combination of COVID-19 and cancer during the first year of the pandemic. Using 2020 mortality data in the US, this cross-sectional study quantified deaths caused by both cancer and COVID-19 and identified the most vulnerable populations.

Methods | We identified deaths that occurred between March 1, 2020, and December 31, 2020, from the Multiple Cause of Death database with death certificate information for US residents. Race and ethnicity information from the database was accessed to depict racial and ethnic disparities. We described the demographic distribution for 2 groups of deaths caused by both cancer and COVID-19: (1) malignant neoplasms (International Statistical Classification of Diseases and Related Health Problems, Tenth Revision [ICD-10] code C00-C97) as underlying cause and COVID-19 (ICD-10 code U07.1) as contributing cause (COVID-related cancer deaths), (2) COVID-19 as underlying cause and malignant neoplasms as contributing cause (cancer-related COVID-19 deaths), and for comparison, (3) deaths from malignant neoplasms without COVID-19 as a contributing cause (non–COVID-related cancer deaths), as well as (4) deaths from COVID-19 without malignant neoplasms as a contributor (non–cancer-related COVID deaths). Percentages were calculated by cancer site when applicable. Analysis was conducted using the CDC WONDER database. Institutional review board approval was exempted per the Common Rule (45CFR§46) because the study used publicly available and deidentified data. This study followed the STROBE reporting guideline.

Results | In March to December 2020, 3142 cancer deaths had COVID-19 as a contributing cause and 13 419 COVID-19 deaths had cancer as a contributing cause (Table). Compared with the...
Table. Characteristics of Cancer and COVID-19 Deaths in the US, March Through December 2020 (continued)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Month in 2020</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>March</td>
<td>51 528 (10.3)</td>
<td>28 (0.9)</td>
<td>281 (2.1)</td>
<td>6469 (1.9)</td>
</tr>
<tr>
<td>April</td>
<td>48 432 (9.7)</td>
<td>271 (8.6)</td>
<td>2061 (15.4)</td>
<td>59 763 (17.7)</td>
</tr>
<tr>
<td>May</td>
<td>48 662 (9.8)</td>
<td>296 (9.4)</td>
<td>1237 (9.2)</td>
<td>33 949 (10.1)</td>
</tr>
<tr>
<td>June</td>
<td>47 703 (9.6)</td>
<td>205 (6.5)</td>
<td>614 (4.6)</td>
<td>15 153 (4.5)</td>
</tr>
<tr>
<td>July</td>
<td>50 332 (10.1)</td>
<td>233 (7.4)</td>
<td>1062 (7.9)</td>
<td>27 112 (8.0)</td>
</tr>
<tr>
<td>August</td>
<td>50 894 (10.2)</td>
<td>262 (8.3)</td>
<td>935 (7.0)</td>
<td>26 005 (7.7)</td>
</tr>
<tr>
<td>September</td>
<td>49 399 (9.9)</td>
<td>218 (6.9)</td>
<td>627 (4.7)</td>
<td>16 179 (4.8)</td>
</tr>
<tr>
<td>October</td>
<td>50 935 (10.2)</td>
<td>262 (8.3)</td>
<td>849 (6.3)</td>
<td>21 181 (6.3)</td>
</tr>
<tr>
<td>November</td>
<td>49 062 (9.9)</td>
<td>533 (17.0)</td>
<td>2070 (15.4)</td>
<td>45 868 (13.6)</td>
</tr>
<tr>
<td>December</td>
<td>51 018 (10.2)</td>
<td>834 (26.5)</td>
<td>3683 (27.4)</td>
<td>85 714 (25.4)</td>
</tr>
</tbody>
</table>

a Underlying cause of death, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) codes C00 to C97; multiple cause of death, ICD-10 codes other than U07.1.
b Underlying cause of death, ICD-10 code U07.1; multiple cause of death, ICD-10 codes other than C00 to C97.
c Underlying cause of death, ICD-10 codes C00-C97; multiple cause of death, ICD-10 code U07.1.
d Underlying cause of death, ICD-10 code U07.1; multiple cause of death, ICD-10 codes C00-C97.
e Urbanization was based on the 2013 National Center for Health Statistics (NCHS) Urban-Rural Scheme for Counties. The large central metro category contains counties in metropolitan statistical areas (MSAs) of 1 million or more population that have been identified by NCHS classification rules as central because they contain all or part of a principal city of the area; the large fringe metro category contains the remaining counties (similar to suburbs) in MSAs of 1 million or more; counties in MSAs of 250 000 to 999 999 population are assigned to the medium metro category and counties in MSAs with populations under 250 000 are assigned to the small metro category. Nonmetropolitan counties that are designated by the Office of Management and Budget as belonging to an MSA are assigned to the micropolitan category and the remaining nonmetropolitan counties are assigned to the noncore category. See more information about the urbanization categories at https://www.cdc.gov/nchs/data_access/urban_rural.htm.
f May not sum to 100% because of unknown values.
g Racial and ethnic categories were recorded in the Multiple Cause of Death database.

Figure. Percentage of Cancer and COVID-19 Deaths in the US, March Through December 2020

A  By place of death

B  By cancer site

ED indicates emergency department.
a Underlying cause of death, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) codes C00 to C97; multiple cause of death, ICD-10 codes other than U07.1.
b Underlying cause of death, ICD-10 codes C00-C97; multiple cause of death, ICD-10 code U07.1.
c Underlying cause of death, ICD-10 code U07.1; multiple cause of death, ICD-10 codes C00-C97.
d Underlying cause of death, ICD-10 code U07.1; multiple cause of death, ICD-10 codes other than C00 to C97.
non–COVID-related cancer deaths, the deaths caused by both cancer and COVID-19 were more likely to occur in large central metropolitan areas; in November or December; among individuals aged greater than or equal to 85 years; of American Indian or Alaska Native, Black, or Hispanic racial and ethnic groups; and in inpatient or nursing home or long-term care settings (Table and Figure).

A higher percent of COVID-related cancer deaths (13.7%) and cancer-related COVID deaths (25.5%) occurred among individuals with hematologic neoplasms compared with non–COVID-related cancer deaths (9.5%) (Figure). Lung cancer was the most common site among non–COVID-related cancer deaths (22.5%). Prostate cancer was more prevalent among deaths caused by both cancer and COVID-19 than in non–COVID-related cancer deaths. Cancers of female genital organs and digestive organs in both sexes were less prevalent among deaths caused by both cancer and COVID-19.

Discussion | In the first 10 months of the pandemic, 16,561 deaths occurred among patients with cancer with complications of COVID-19 in the US. Risk factors for COVID-19 deaths among the general population,4 including older age, minority race and ethnicity groups, and large central metropolitan residence, were more prevalent in deaths caused by both cancer and COVID-19 than in non–COVID-related cancer deaths. The high proportion of deaths caused by both cancer and COVID-19 in medical facilities suggests a high economic burden to be evaluated in future studies. The finding of hematologic neoplasms is consistent with previous studies from medical institutions,5,6 although the finding of prostate cancer is novel and merits further examination. A limitation is that we were unable to consider cancer stage and treatment due to lack of information. Ongoing monitoring of the mortality burden from COVID-19 variants (eg, Delta and Omicron) among patients with cancer is warranted, especially after vaccines became available.

Xuesong Han, PhD
Xin Hu, MSPH
Jingxuan Zhao, MPH
Ahmedin Jemal, DVM, PhD
K. Robin Yabroff, PhD

Author Affiliations: Surveillance & Health Equity Science, American Cancer Society, Atlanta, Georgia (Han, Zhao, Jemal, Yabroff); Department of Health Policy and Management, Rollins School of Public Health, Emory University, Atlanta, Georgia (Hu).

Accepted for Publication: July 27, 2022.
Published Online: September 29, 2022. doi:10.1001/jamaoncol.2022.4315

Corresponding Author: Xuesong Han, PhD, American Cancer Society, 3380 Chastain Meadows Pkwy NW, Ste 200, Kennesaw, GA 30144 (xuesong.han@cancer.org).

Author Contributions: Dr Han had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Han, Zhao, Yabroff.
Acquisition, analysis, or interpretation of data: Han, Hu, Jemal.
Drafting of the manuscript: Han.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Han.
Administrative, technical, or material support: Han, Hu.
Supervision: Han.

Conflict of Interest Disclosures: Dr Han reported receiving grants from AstraZeneca outside the submitted work. Dr Hu reported receiving grants from PhRMA Foundation Predoctoral fellowship outside the submitted work. Ms Zhao reported receiving grants from AstraZeneca outside the submitted work. Dr Yabroff reported serving on the Flatiron Health Equity Advisory Board. All honoraria are donated to Dr Yabroff’s employer, the American Cancer Society. No other disclosures were reported.

Additional Information: Data are from the Multiple Cause of Death Database provided through CDC WONDER at https://wonder.cdc.gov/mcd-icd10.html.