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December 20, 2020

José Romero, MD
Chairman
Advisory Committee on Immunization Practices (ACIP)
Centers for Disease Control and Prevention
1600 Clifton Road, NE, Mailstop H24-8
Atlanta, GA 30329-4027

Re: COVID-19 Vaccine Prioritization, Distribution and Administration; Docket No. CDC-2020-0124

Filed electronically at regulations.gov

Dear Chairman Romero:

On behalf of the more than 47,000 laboratory, translational, and clinical researchers; physicians and other healthcare professionals; population scientists; and patient advocates who constitute the national and international membership of the American Association for Cancer Research (AACR), we thank you for your commitment to providing guidance and recommendations to the Centers for Disease Control (CDC), the Department of Health and Human Services (HHS), and jurisdictions across the United States regarding priority access to the COVID-19 vaccine, and we appreciate the opportunity to provide specific comments to the Advisory Committee on Immunization Practices (ACIP) regarding the allocation of initial supplies of COVID-19 vaccines.

The AACR is the world's first and largest professional organization dedicated to advancing cancer research and its mission to prevent and cure all cancers. We marshal the full spectrum of expertise in cancer research to identify the top scientific priorities; convene scientific conferences and educational workshops all over the world; publish nine high-impact, peer-reviewed scientific journals; produce a magazine for cancer survivors, patients, and their caregivers; and work to raise funds from the philanthropic community for meritorious, lifesaving cancer research.

The AACR and its COVID-19 and Cancer Task Force recommends that patients with cancer be considered for priority access to COVID-19 vaccines due to their increased risk of mortality from COVID-19 infection. The AACR has put forward this conclusion after reviewing the available literature (28 publications) on fatality rates of patients with cancer who developed COVID-19. According to the Task Force's review:

- COVID-19 fatality rates for patients with cancer were double that of patients without cancer.

- Even when adjusted for age, sex, and comorbidities, the mortality rates trended upward, indicating a greater risk for severe disease and mortality due to COVID-19 in patients with cancer.

This position paper from the AACR along with the information supporting this recommendation was published on December 19, 2020, in the high-impact AACR journal *Cancer Discovery*. The position paper is also included as an addendum to these comments. In addition, the paper is available for your review at https://cancerdiscovery.aacrjournals.org/content/early/2020/12/19/2159-8290.CD-20-1817.

The position paper from the AACR's expert COVID-19 and Cancer Task Force builds on the rapidly growing body of research into the consequences of the pandemic for cancer patients.

We appreciate your consideration of our views, and we stand ready to work with you and your colleagues on the committee as the ACIP continues its work related to COVID-19 vaccine development, distribution, and allocation planning.

Sincerely,

Antoni Ribas, MD, PhD
AACR President, 2020-2021
UCLA Medical Center
Los Angeles, CA

Margaret Foti, PhD, MD (hc)
Chief Executive Officer
American Association for Cancer Research

Addendum: The aforementioned AACR position paper that is pasted below is also available at https://cancerdiscovery.aacrjournals.org/content/early/2020/12/19/2159-8290.CD-20-1817.

Priority COVID-19 vaccination for patients with cancer

while vaccine supply is limited

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advisory board (SAB) and holds stock in Advaxis, Apricity, Arcus, Compugen, CytomX, Five Prime, Highlight, ImaginAb, Isoplexis, Kite-Gilead, Lutris, Merus, PACT, RAPT, Rgenix and Tango Therapeutics, and receives research funding from the National Cancer Institute, Agilent, Bristol-Myers Squibb through Stand Up to Cancer (SU2C), the Melanoma Research Alliance and the Parker Institute for Cancer Immunotherapy. R.S., T.L. and S.K.Z. are employees of the American Association for Cancer Research. K.M.C. is a shareholder in Geneoscopy, honoraria from PACT Pharma and receives funding from the National Cancer Institute and the Cancer Research Institute. J.M.C. receives research funding from the National Institutes of Health. E.M.J. is a paid consultant for Adaptive Biotech, CSTONE, Achilles, DragonFly, and Genocea. She receives funding from Lustgarten Foundation and Bristol Myer Squibb. She is the Chief Medical Advisor for Lustgarten and SAB advisor to the Parker Institute for Cancer Immunotherapy (PICI) and for the C3 Cancer Institute. E.J.W. is a founder of Surface Oncology and Arsenal Biosciences, has a patent licensing agreement on the PD-1 pathway with Roche/Genentech, is an inventor on a patent (US Patent number 10,370,446) submitted by Emory University that covers the use of PD-1 blockade to treat infections and cancer, and receives research funding from the National Institutes of Health, the National Cancer Institute, the Allen Institute for Immunology and the Parker Institute for Cancer Immunotherapy. J-C.S. has been Full time employee for AstraZeneca (September 2017–December 2019), is a shareholder of AstraZeneca, Daiichi Sankyo, Gritstone and Hookipa, and has received consulting fees from Relay Therapeutics. G.D'S. receives research funding from the National Institutes of Health.

Summary: Published series on COVID-19 support the notion that patients with cancer are a particularly vulnerable population. There is confluence of risk factors between cancer and COVID-19, and cancer care and treatments increase exposure to the virus and may dampen natural immune responses. The available evidence supports the conclusion that patients with cancer, in particular with hematological malignancies, should be considered among the high-risk groups for priority COVID-19 vaccination.

Article Text: At this time of limited supply of the highly effective COVID-19 vaccines, it is important to gather the evidence on the risk of complications and death resultant from a diagnosis of COVID-19 infection in patients with cancer. After reviewing 28 publications that included relevant information on fatality rates of patients with cancer who developed COVID-19 (1-28), we conclude that patients with an active cancer should be considered for

priority access to COVID-19 vaccination, along other particularly vulnerable populations with risk factors for adverse outcomes with COVID-19. This recommendation is consistent with the Advisory Committee on Immunization Practices (ACIP) within the Centers for Disease Control and Prevention (CDC). The ACIP considered multiple groups to recommend for early access to a limited COVID-19 vaccine supply and concluded that patients with cancer are at a higher risk for severe COVID-19, and should be one of the groups considered for early COVID-19 vaccination (29). Given that there are nearly 17 million people living with a history of cancer in the United States alone, it is critical to understand whether these individuals are at a higher risk to contract SARS-COV-2 and to experience severe outcomes from COVID-19.

Our review of the available literature to provide the scientific support for early access during the time of limited supplies of COVID-19 vaccines was based on a literature search for peer-reviewed publications using PubMed. We selected articles that reported either case fatality rates (CFR) or the mortality risks among SARS-COV-2-infected patients with cancer. We excluded articles with cohort sizes of fewer than 90 patients. Of 28 articles selected, 16 included one or more control cohorts, with 13 studies reporting on direct comparisons of outcomes from SARS-COV-2-infected patients with cancer with those without cancer (**Supplementary Table S1**) (1-13). Of these 13 studies, 11 reported CFRs among patients with cancer with a SARS-COV-2 infection. Nine out of the 11 studies reported a higher CFR in patients with a SARS-CoV2 infection and cancer compared to patients with infection but no cancer (**Figure 1**). Examples from studies from different parts of the world include a series from Wuhan, China with CFRs of 22% with cancer and 11% without cancer (10), from New York, USA with CFRs of 28% with cancer and 14% without cancer (11), a series from Louisiana, USA with CFRs of 21% with cancer and 9% without cancer (5), and a series from Europe with CFRs of 22% with cancer and 14% without cancer (4) (**Supplementary Table S1**). Three series compared outcomes among SARS-COV-2 infected patients with cancer with uninfected patients with cancer, with two reporting higher mortality in patients with cancer and COVID-19 (**Supplementary Table S2**) (14-16).

Analysis of adjusted ratios (hazard ratio or odds ratio) confirm a greater risk for severe disease and mortality from COVID-19 in patients with cancer, with variability among series but an overall clear trend (**Figure 2**). To determine whether the increased mortality from COVID-19 in patients with cancer was attributable to their

underlying malignancies or any of the other factors that are associated with worse outcomes (such as advanced age or adverse comorbidities), several studies adjusted for age, sex, and comorbidities in their analyses and presented the ratios of mortality risks among patients with cancer and a SARS-COV-2 infection compared with those without cancer. Patients diagnosed with hematologic malignancies were at an especially higher risk. An example is a series from a single hospital in New York, USA with CFR of 37% in patients with hematological malignancies, compared to 25% in patients with solid cancers. Additional factors like differences in older age, advanced COVID-19 disease and hospitalizations, and overall quality of care received can all impact outcomes of COVID-19 in patients with cancer.

Nine studies did not include a control or reference group in their analysis (**Supplementary Table S3**) (17-25). These studies reported a high CFR among SARS-COV-2-infected patients with cancer, which seem to be higher when indirectly compared with existing national or global statistics. However, it is difficult to interpret these data in the absence of an appropriate concurrent control cohort from the same hospital or healthcare system. The remaining three studies were meta-analyses, two of which confirmed that patients with cancer were at increased risk of fatality and severe illness due to COVID-19 when aggregating all of the available series into an overall estimate (**Supplementary Table S4**) (26-28).

Information is limited on the effects of COVID-19 vaccination in patients with cancer. Among the 43,540 subjects enrolled in the BNT162b2 mRNA COVID-19 vaccine trial, 3.7% were reported to have cancer, with a total of five patients developing COVID-19 at the time of reporting (one in the vaccine arm and four in the placebo arm) (30). Other large COVID-19 vaccine trials with further follow up will provide useful information on the effectiveness of the vaccines in patients receiving different cancer treatments, as there is currently not enough data to evaluate the interactions between active oncologic therapy with the ability to induce protective immunity to COVID-19 with vaccination (30). Given the evidence that the COVID-19 vaccines may provide greater levels of neutralizing antibodies than the SARS-CoV2 infection in a substantial number of patients (31,32), it would be of high importance to offer priority vaccinations to patients receiving cytotoxic chemotherapy, in particular for hematological malignancies. Current data suggests that patients with hematological malignancies have limited

immune responses to COVID-19 (33). Patients who do not mount a strong immune response against SARS-COV2 are likely to shed the virus for a longer time and be a source of continued unintended exposure infecting other persons. Therefore, the case for vaccinating patients with certain cancers who have limited ability to mount a natural neutralizing antibody response to COVID-19 infection is further strengthened to prevent spread to others, in particular given their need for frequent visits to clinics to continue with their cancer care. It is possible that patients with certain cancers receiving anti-CD20 or cytotoxic therapies may not demonstrate an antibody response to the COVID-19 vaccination, but since the current vaccines demonstrate a strong T cell response it is possible that they would result in protective T cell immunity. Therefore, the benefit of COVID-19 vaccination may not be adequately assessed with serological testing in these patients.

Finally, after over a decade of clinical testing there is currently no evidence that cancer immunotherapy with immune checkpoint blockade increases the complications from any prior viral vaccine administration. Despite that three of the series we reviewed (5,19,21) reported that patients receiving cancer immunotherapies had increased risk of complications and death from COVID-19, it is now recognized that this may reflect the confluence of comorbidities and risk factors in these patients; for example, patients with lung cancer induced by cigarette smoke, who are more likely to have pre-existing lung inflammatory disease which is an adverse risk factor for COVID-19, are more likely to be treated with immune checkpoint blockade therapies (34). This patient population reflecting several comorbidities may be particularly vulnerable and would benefit from priority vaccination. Therefore, it is reasonable to recommend that patients receiving cancer immunotherapies should be considered for priority COVID-19 vaccination regardless of receiving this therapy.

We conclude that the data in these studies support of the recommendation to provide priority COVID-19 vaccination to patients with cancer due to their increased risk of mortality with COVID-19 infection. This recommendation should result in early vaccination to patients who are currently receiving treatment for cancer, or have an advanced cancer that may result in increased risk of complications from COVID-19, in particular for patients with hematological malignancies and lung cancer. It is unclear whether this recommendation should be applicable to patients with a past diagnosis of cancer, as cancer survivors can be considered having the same

risk as other persons with matched age and other risk factors. The fact that patients undergoing cancer treatments are in very frequent contact with healthcare workers increases the risk of exposure and puts the patients at the front-line of our healthcare system.

Figures

Figure 1. Scatter plot of COVID-19-related case fatality rates from series comparing rates from patients with cancer (red dots) compared to patients without cancer (grey dots)

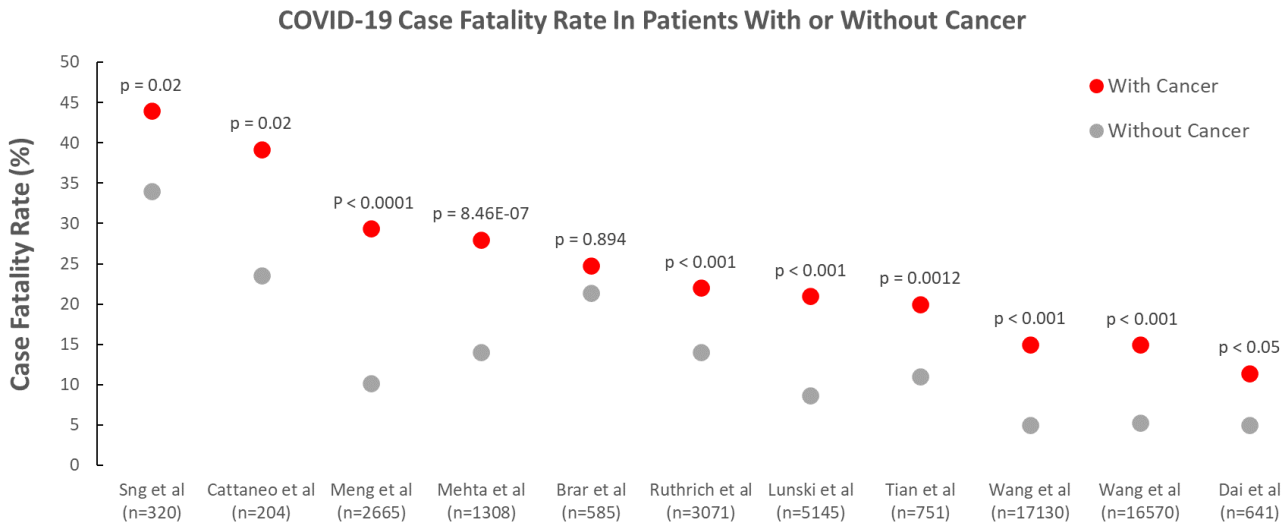
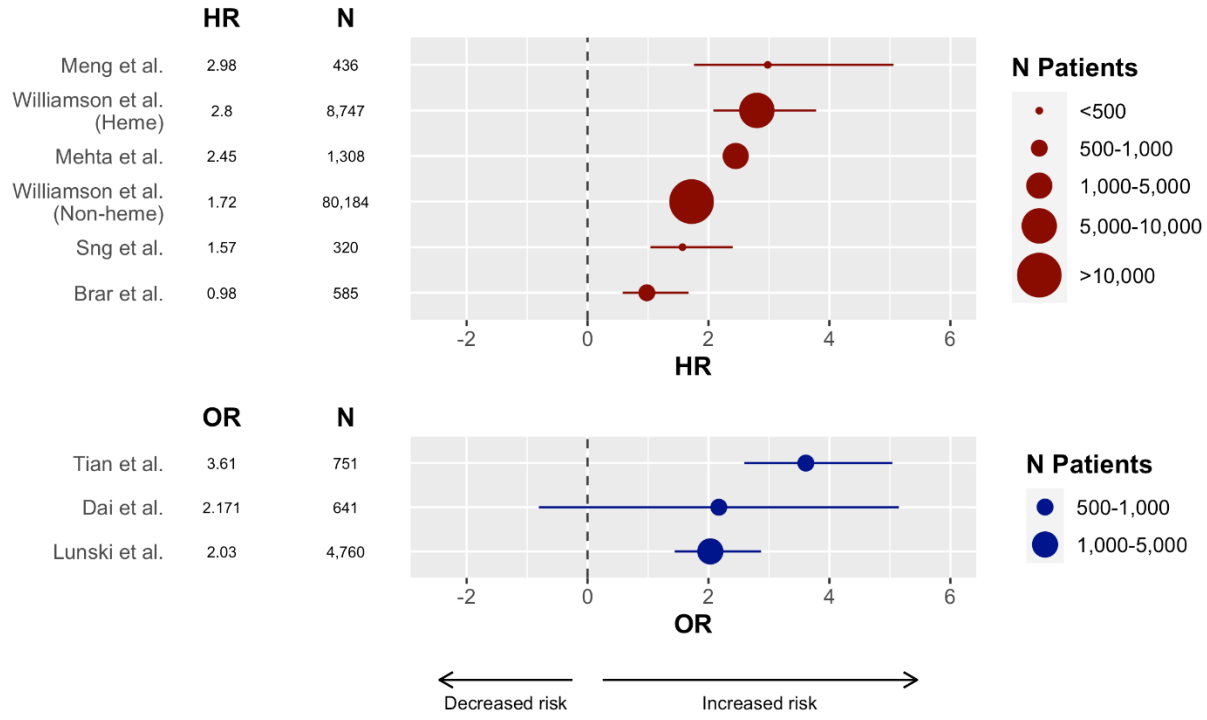


Figure 2. Forest plot of series reporting hazard ratios (HR, top in red) or odds ratios (OR, bottom in blue) for death, or severity of COVID-19 in case of the Tian series, in patients with COVID-19 and cancer compared to no cancer. The size of the symbol is proportional to the number of individuals in each series. The line represents the lower and upper limit of the 95% confidence intervals. Negative HR or OR values favor decreased risk for death, while positive values represent increased risk for death from COVID-19.



Supplemental Data

Supplemental Table S1. Studies comparing outcomes among SARS-COV-2 infected patients with cancer and those without cancer.

Supplemental Table S2. Studies comparing outcomes among SARS-COV-2 infected patients with cancer and uninfected patients with cancer

Supplemental Table S3. Studies reporting outcomes among SARS-COV-2 infected patients with cancer without any comparison

Supplemental Table S4. Metanalyses of published studies on COVID-19-cancer connection

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