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Brief Communications

Association of the COVID-19 Pandemic With Patterns of Statewide Cancer Services

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic led to delayed medical care in the United States. We examined changes in patterns of cancer diagnosis and surgical treatment between January 1 and December 31 in 2020 and 2019 with real-time electronic pathology report data from population-based Surveillance, Epidemiology, and End Results cancer registries from Georgia and Louisiana. During 2020, there were 29 905 fewer pathology reports than in 2019, representing a 10.2% decline. Declines were observed in all age groups, including children and adolescents younger than 18 years. The nadir was early April 2020, with 42.8% fewer reports than in April 2019. Numbers of reports through December 2020 never consistently exceeded those in 2019 after first declines. Patterns were similar by age group and cancer site. Findings suggest substantial delays in diagnosis and treatment services for cancers during the pandemic. Ongoing evaluation can inform public health efforts to minimize any lasting adverse effects of the pandemic on cancer diagnosis, stage, treatment, and survival.

The first cases of coronavirus disease 2019 (COVID-19) in the United States were identified on January 20, 2020 (1). By the end of March, there were more than 100 000 cases and 2000 deaths nationally (1). Stay-at-home orders and suspension of nonessential medical services were enacted in many states. Several reports based predominately on health insurance claims data described dramatic declines in cancer screening (2-4), diagnosis (2,5), and treatment (4). Early reports during the spring are limited, however, for comprehensively tracking trends because of the timing required for insurance claims adjudication, select providers and patient populations (eg, patients aged ≥65 years), and losses of employer-sponsored health insurance coverage resulting from unemployment.

Cancer incidence data in population-based registries lag 2 to 3 years from diagnosis to release date, limiting utility for timely assessment of the impact of the COVID-19 pandemic on cancer detection and care. Surveillance, Epidemiology, and End Results (SEER) registries, however, have captured real-time cancer pathology reports for many years; most solid tumors are pathologically confirmed, and all surgically resected specimens have corresponding pathology. This study used real-time electronic pathology data from 2 population-based SEER registries to assess patterns in cancer detection and surgical treatment during the pandemic.

Electronic pathology reports from the Georgia and Louisiana SEER registries were selected from the pathology laboratories that consistently transmitted reports from January 2018 to December 2020 (91.2% and 86.4% of all reports, respectively). Each report provides specimen collection date and patient birth date. Anatomic site of the cancer was classified with a validated algorithm that uses natural language processing (6). Trends for breast, colorectal, lung, and prostate cancers were assessed separately because these are the most common cancers and algorithm performance for these sites was high based on historical 2018 registry data, the most recent year with complete incidence data. The average number of pathology reports per cancer case in 2018 was highest for breast (n = 3.4), followed by lung (n = 2.6), colorectal (n = 2.3), and prostate (n = 1.2) cancers, reflecting differences in staging procedures and surgical management.

Pathology reports were grouped biweekly by specimen collection date for each age group and by cancer site. The number, distribution, and patterns of biweekly reports were compared in

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Table 1. Characteristics of pathology reports in Georgia and Louisiana during January-December 2019 and 2020

Characteristic	Year		Decline between 2019 and 2020	
	January-December 2019 No. (%)	January-December 2020 No. (%)	No.	% (95% CI)
Total	294 113 (100)	264 208 (100)	29 905	10.2 (10.2 to 10.2)
State				
Georgia	198 081 (67.3)	177 180 (67.1)	20 901	10.6 (10.5 to 10.6)
Louisiana	96 032 (32.7)	87 028 (32.9)	9004	9.4 (9.4 to 9.4)
Age[a], y				
<18	6176 (2.1)	3810 (1.4)	2366	38.3 (38.3 to 38.5)
18–29	7675 (2.6)	7169 (2.7)	506	6.6 (6.5 to 6.7)
30–39	15 041 (5.1)	13 745 (5.2)	1296	8.6 (8.6 to 8.7)
40–49	28 721 (9.8)	26 057 (9.9)	2664	9.3 (9.3 to 9.4)
50–59	56 294 (19.1)	50 661 (19.2)	5633	10.0 (10.0 to 10.1)
60–64	40 227 (13.7)	35 664 (13.5)	4563	11.3 (11.3 to 11.4)
65–69	43 758 (14.9)	39 507 (15.0)	4251	9.7 (9.7 to 9.8)
70–79	68 434 (23.3)	63 049 (23.9)	5385	7.9 (7.9 to 7.9)
≥80	27 763 (9.4)	24 530 (9.3)	3233	11.6 (11.6 to 11.7)
Cancer site				
Breast	65 714 (22.3)	59 767 (22.6)	5947	9.0 (9.0 to 9.1)
Prostate	15 597 (5.3)	14 700 (5.6)	897	5.8 (5.7 to 5.9)
Colorectal	22 515 (7.7)	19 822 (7.5)	2693	12.0 (11.9 to 12.0)
Lung	33 530 (11.4)	27 686 (10.5)	5844	17.4 (17.4 to 17.5)
Other sites	156 757 (53.3)	142 233 (53.8)	14 524	9.3 (9.3 to 9.3)

[a]Age was missing from 24 pathology reports in 2019 and 16 reports in 2020. CI = confidence interval.

2020 with the same period in 2019. Biweekly COVID-19 mortality rates per 100 000 people for 2020 in Georgia and Louisiana were obtained from the US Centers for Disease Control and Prevention(https://data.cdc.gov/NCHS/Weekly-Provisional-Counts-of-Deaths-by-State-and-S/muzy-jte6). We generated 95% confidence intervals for numbers of reports and the percentage difference in 2020 and 2019 by using a simulation method based on a Poisson distribution with 1000 replications (7). This study used deidentified, routinely captured surveillance data covered under existing registry authorizations and institutional review board approvals.

There were 29 905 fewer pathology reports in 2020 than in 2019, representing a 10.2% decline (Table 1). Absolute declines in the number of reports were greatest among adults aged 50 years or older (n = 23 065); percentage declines were greatest among children and adults younger than 18 years of age (38.3%). By cancer type, absolute declines were greatest for breast (n = 5947) and lung (n = 5844) cancers; percentage declines were greatest for lung (17.4%) and colorectal (12.0%) cancers.

Between January and early March 2020, biweekly numbers of pathology reports were similar, though occasionally higher, than those during the same period of 2019 (Figure 1; Supplementary Figure 1, available online). The nadir was early April 2020, with 42.8% fewer reports than in April 2019. Declines coincided with peaks in biweekly COVID-19 mortality rates. Numbers in 2020 never consistently exceeded those in 2019 after the first decline in March.

Biweekly patterns of pathology reports in 2020 and 2019 were similar by cancer site, with some variation in timing, magnitude, and duration of declines (Supplementary Figure 2, available online). Biweekly patterns in 2020 and 2019 were similar by age group (Supplementary Figure 3, available online). Numbers and patterns of reports were similar in 2018 and 2019 overall (Supplementary Figure 4, A and C, available online) and in Georgia (Supplementary Figure 4, B, available online) and Louisiana (Supplementary Figure 4, C, available online), suggesting that reports in 2019 were consistent with historic patterns and 2019 was not itself an unusual year.

This study provides evidence for adverse effects of the COVID-19 pandemic on delays in cancer detection and surgical treatment using real-time pathology data through December 2020 from population-based cancer registries. Overall, there were nearly 30 000 fewer reports in 2020 than in 2019, representing a 10.2% decline over the 12 months of 2020, the longest observation period to date for studies evaluating the effects of COVID-19 on cancer-related trends. Patterns of declines were generally similar to those reported elsewhere (2,5), with the greatest differences in April 2020 relative to April 2019, the first peak in COVID-19 mortality rates. Declines in pathology reports in August, November, and December coincided with later peaks in COVID-19 mortality rates. Notably, numbers of reports through December 2020 did not consistently exceed 2019 levels after declines in March, which might be expected if a backlog of cancer diagnoses were resolved. We observed declines in cancers with effective screening tests, including breast, colorectal, and lung cancers. Furthermore, we observed substantial declines across cancer sites and age groups without effective screening tests, including children and young adults, suggesting delays in routine well-child and primary care, evaluation of signs and symptoms, and treatment initiation for most cancers. Ongoing evaluation of trends will be important.

Increases in the uninsured population throughout 2020 (8) may adversely affect timely return to routine care, regular cancer screening, evaluation of signs and symptoms, and cancer diagnosis. Fears of COVID-19 infection may have reduced initiation and completion of cancer treatment. Ongoing monitoring of population-based data will be critical for informing public health efforts to minimize any lasting adverse effects of the COVID-19 pandemic on delays in cancer diagnosis, shifts to later-stage diagnosis, receipt of timely treatment, and survival. Evaluation of racial/ethnic, socioeconomic, and geographic disparities in care and outcomes will be important as these data become available.

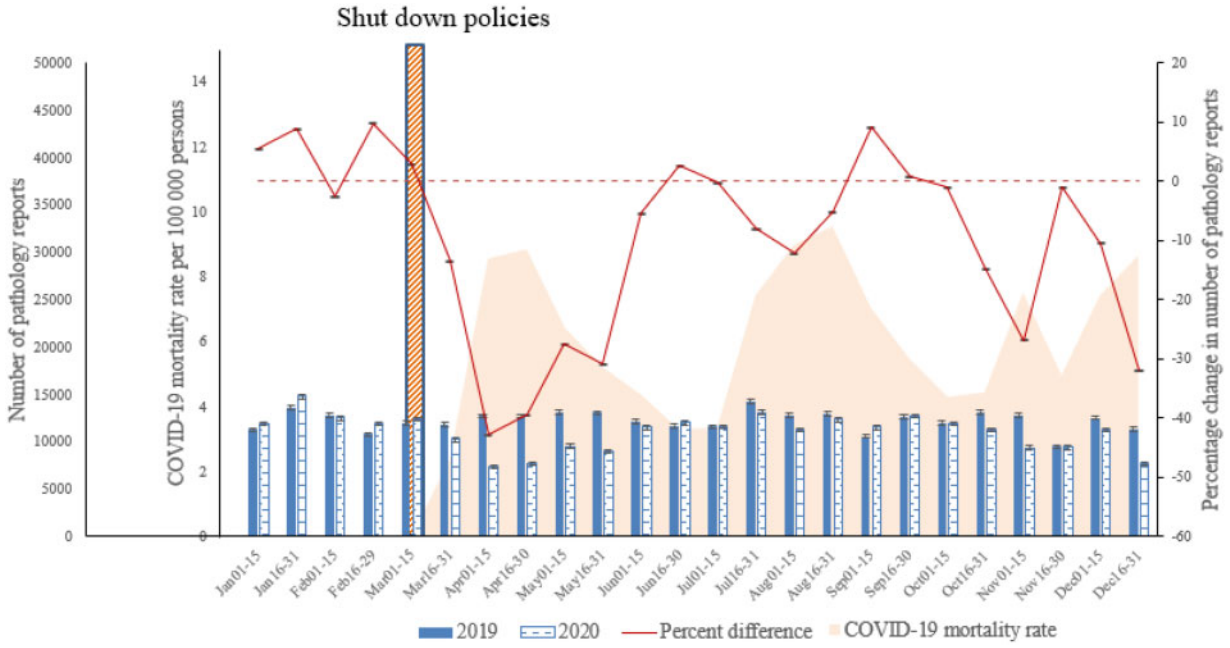

Figure 1. Cancer Pathology Reports: 2019 and 2020. This figure shows the number of cancer pathology reports in Georgia and Louisiana in biweekly intervals to allow comparison of the same period in 2019 as in 2020. Numbers of pathology reports (**blue bars**) are shown with the primary y-axis, the coronavirus disease 2019 (COVID-19) mortality rate per 100 000 population in Georgia and Louisiana (**light orange area**) is shown with the secondary y-axis, and the percentage change in the number of pathology reports between 2019 and 2020 (**red solid line**) is shown with the tertiary y-axis. Shutdown policies announced in March 2021 are indicated by the **vertical bar.**

This study has limitations. Data are from only 2 states, although both states have urban and rural regions and diverse populations. Additionally, data are from pathology reports, not all cancer diagnoses, and the number of reports per cancer case varies by site in historical data, although this ratio should be similar across years, allowing for trend comparisons. Nonetheless, the substantial declines in cancer pathology reports in 2020 from the population-based data used in this study suggest substantial delays in cancer diagnosis and treatment as an indirect result of the COVID-19 pandemic.

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Prior presentations: Preliminary findings will be presented at the 2021 American Society for Clinical Oncology Annual Meeting, June 4, 2021.

Data Availability

Electronic pathology report data from the Georgia and Louisiana SEER registries are not part of the publicly available SEER data release.

References

1. Stokes EK, Zambrano LD, Anderson KN, et al. Coronavirus disease 2019 case surveillance—United States, January 22-May 30, 2020. *Morb Mortal Wkly Rep*. 2020;69(24):759–765. doi:10.15585/mmwr.mm6924e2
2. London JW, Fazio-Eynullayeva E, Palchuk MB, Sankey P, McNair C. Effects of the COVID-19 pandemic on cancer-related patient encounters. *JCO Clin Cancer Inform*. 2020;4:657–665. doi:10.1200/CCI.20.00068. [32716647]
3. EPIC Health Research Network: Preventive cancer screenings during COVID-19 pandemic, 2020. https://www.ehrn.org/articles/delays-in-preventive-cancer-screenings-during-covid-19-pandemic/. 2020.
4. Patt D, Gordan L, Diaz M, et al. Impact of COVID-19 on cancer care: how the pandemic is delaying cancer diagnosis and treatment for American seniors. *JCO Clin Cancer Inform*. 2020;4:1059–1071. doi:10.1200/CCI.20.00134.
5. Kaufman HW, Chen Z, Niles J, Fesko Y. Changes in the number of US patients with newly identified cancer before and during the coronavirus disease 2019 (COVID-19) pandemic. *JAMA Netw Open*. 2020;3(8):e2017267. doi:10.1001/jamanetworkopen.2020.17267. [32749465]
6. Alawad M, Gao S, Qiu JX, et al. Automatic extraction of cancer registry reportable information from free-text pathology reports using multitask convolutional neural networks. *J Am Med Inform Assoc*. 2020;27(1):89–98. doi:10.1093/jamia/ocz153.
7. Greenland S. Interval estimation by simulation as an alternative to and extension of confidence intervals. *Int J Epidemiol*. 2004;33(6):1389–1397. doi:10.1093/ije/dyh276.
8. McDermott D, Cox C, Rudowitz R, Garfield R. How has the pandemic affected health coverage in the U.S.? Kaiser Family Foundation Web site. https://www.kff.org/policy-watch/how-has-the-pandemic-affected-health-coverage-in-the-u-s/. Published December 9, 2020. Accessed December 17, 2020.