Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Conflicts of interest

None disclosed.

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Delays in melanoma presentation during the COVID-19 pandemic: A nationwide multi-institutional cohort study

To the Editor: The COVID-19 pandemic disrupted health care, including melanoma care. We sought to quantify the impact of the pandemic on melanoma stage at diagnosis.

Retrospective cohort data were collected at 12 academic centers nationwide with dedicated melanoma clinics. All sites received institutional review board approval. Melanoma cases were categorized as pre-COVID-19 (March 1, 2019-February 29, 2020) or COVID-19 (March 1, 2020-February 28, 2021) based on biopsy dates. Sites enrolled the first 17 cases per month (204 cases per era), although occasionally fewer cases were collected due to patient volume. Multivariable analysis estimated effects on histopathologic eighth edition American Joint Committee on Cancer staging features, adjusting for demographics.

The COVID-19 and pre-COVID-19 eras included 1834 and 2062 melanoma cases, respectively. Patient characteristics are summarized in Supplementary Table I, available via Mendeley at https://data.mendeley.com/datasets/rrrmb39nr7/1. In the COVID-19 era, there were relative increases in patient-detected melanomas (54.0% vs 47.8%; $P < .001$), nodular subtype (12.7% vs 9.8%; $P = .005$), mean thickness (1.77 vs 1.49 mm; $P < .001$), positive ulceration (20.0% vs 15.4%; $P < .001$), and mean mitotic rate (3.03 vs 2.56 mitoses/mm^2; $P < .001$) compared to the pre-

Table I. Multivariable-adjusted odds ratios (aORs)* of diagnosis era (COVID-19 vs pre-COVID-19) by melanoma characteristics

	aOR* (95% CI)	*P*-value†
Melanoma subtype		
Superficial spreading	Ref	-
Nodular	1.42 (1.06-1.89)	**.009**
Acral lentiginous	1.04 (0.53-2.01)	.95
Other/unknown	1.16 (0.92-1.45)	.18
Thickness (mm)		
≤1.0	Ref	-
>1.0-2.0	1.13 (0.88-1.44)	.26
>2.0-4.0	1.41 (1.07-1.86)	**.006**
>4.0	1.50 (1.10-2.04)	**.003**
Unknown	1.04 (0.34-3.24)	1
Ulceration‡		
No	Ref	-
Yes	1.40 (1.13-1.73)	**<.001**
Biopsy margin status		
Negative	Ref	-
Positive	1.13 (0.89-1.44)	.38
Unknown	0.85 (0.53-1.36)	.61
Mitotic rate (mitoses/mm^2)		
0	Ref	-
1	1.07 (0.82-1.40)	.81
>1	1.41 (1.17-1.71)	**<.001**
AJCC clinical stage§		
I	Ref	-
II	1.37 (1.10-1.72)	**.002**
III	1.01 (0.69-1.48)	1
IV	1.44 (0.94-2.23)	.09
Unknown	1.48 (0.73-3.01)	.28
SLNB result		
Negative	Ref	-
Positive	0.89 (0.62-1.26)	.98
Other/unknown	0.35 (0.03-4.62)	1
SLNB not performed	0.81 (0.68-0.95)	**.008**

Bold values indicate statistically significant results, defined as $P < .05$.

AJCC, American Joint Committee on Cancer; *aOR*, adjusted odds ratio; *CI*, confidence interval; *mm*, millimeters; *ref*, reference; *SLNB*, sentinel lymph node biopsy.

*All outcomes adjusted for age at diagnosis, sex, race, ethnicity, and personal and family history of melanoma.

†*P*-values were computed using a Wald test for the regression coefficients (log odds ratios). *P*-values and 95% confidence intervals were adjusted using the false discovery rate method to account for multiple comparisons.

‡There was not enough data for "unknown" ulceration status to estimate odds ratios.

§The eighth edition American Joint Committee on Cancer (AJCC-8) melanoma staging system was used.

COVID-19 era (Supplementary Table II, available via Mendeley at https://data.mendeley.com/datasets/rrrmb39nr7/1).

Relative frequency of stage I (67.6% vs 72.7%; $P = .001$) melanoma was lower in the COVID-19 era but was higher for stage II (18.3% vs 14.8%; $P = .006$) and stage IV (6.1% vs 4.6%; $P = .045$) melanomas. There was a relatively lower proportion of stage I melanomas diagnosed during the COVID-19 pandemic for all months except for January 2020 vs 2021 (Supplementary Fig 1, available via Mendeley at https://data.mendeley.com/datasets/rrrmb39nr7/1). There was no difference between time from biopsy to wide local excision during the 2 eras (Supplementary Table II).

On multivariable analysis, odds of thickness >2.0-4.0 mm (adjusted odds ratio [aOR], 1.41; 95% CI, 1.07-1.86; $P = .006$), thickness >4.0 mm (aOR, 1.50; 95% CI, 1.10-2.04; $P = .003$), ulceration (aOR, 1.40; 95% CI, 1.13-1.73; $P < .001$), mitoses >1/mm^2 (aOR, 1.41; 95% CI, 1.17-1.71; $P < .001$), nodular subtype (aOR, 1.42; 95% CI, 1.06-1.89; $P = .009$), and stage II melanoma (aOR, 1.37; 95% CI, 1.10-1.72, $P = .002$) were increased during the COVID-19 era (Table I).

In this nationwide multi-institutional study, we observed increased proportions of more advanced melanomas with aggressive features,[1] similar to smaller cohort studies abroad and in the United States.[2,3] Our findings, coupled with declining rates of new melanoma cases nationally, suggest that melanoma cases went undiagnosed during the COVID-19 pandemic and subsequently presented at later stages.[4] As the proportion of internal diagnoses vs referrals and time from biopsy to wide local excision remained stable in our study, it is unlikely that patients simply sought care elsewhere during the pandemic or that procedural delays caused the observed findings.

Prior data suggest that asymptomatic melanomas detected incidentally are diagnosed at earlier stages.[5] We observed increased rates of patient-identified melanomas and decreased rates of provider-identified melanomas during the COVID-19 pandemic, with more advanced staging at diagnosis, suggesting the importance of screening high-risk individuals.

Limitations of our study include generalizability as it only included academic centers and inability to assess melanoma incidence changes due to unknown total case numbers. Future studies are needed to investigate long-term effects of the COVID-19 pandemic on melanoma morbidity, mortality, and health care costs. Our findings emphasize the importance of minimizing melanoma diagnostic delays.

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Conflicts of interest

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