Shorter survival and later stage at diagnosis among unmarried patients with cutaneous melanoma: A US national and tertiary care center study

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Background: Addressing risk factors of delayed melanoma detection minimizes disparities in outcome.

Objective: To elucidate the significance of marital status in melanoma outcomes across anatomic sites.

Methods: Retrospective cohort study of 73,558 patients from the Surveillance, Epidemiology, and End Results (SEER) program and 2992 patients at Johns Hopkins University. Patients were stratified by marital status, anatomic site, age, and sex. Endpoints were prevalence of advanced melanoma (stages III or IV) and survival.

Results: In the SEER cohort, single patients were more likely than married patients to present in stages III or IV among both men (prevalence ratio [PR], 1.45; 95% confidence interval [CI], 1.37-1.53) and women (PR, 1.28; 95% confidence interval, 1.18-1.39). This trend was consistent across all anatomic sites and in all age groups, particularly in those 18 to 68 years old. Overall and cancer-specific survival times were shorter in unmarried patients. Similarly, at Johns Hopkins, single patients had increased prevalence of advanced melanoma (PR, 1.54; 95% CI, 1.21-1.94) and experienced shorter overall survival (hazard ratio, 1.51; 95% CI, 1.15-1.99).

Limitations: The anatomic sites were not very specific, and this was a retrospective study.

Conclusions: Unmarried patients, especially men and those younger than 68 years, are diagnosed at more advanced stages, even in readily visible sites such as the face. They also experience worse survival independent of stage. (J Am Acad Dermatol 2020;83:1012-20.)

Key words: married; melanoma; stage; survival.

A link between marital status and patient outcomes has been described in multiple malignancies, including melanoma.[1-3] Unmarried patients are more likely to present with advanced stages of cancer, and this association is more pronounced among men.[1,4] Unmarried patients with melanoma are more likely to present with tumors larger than 1 mm in Breslow thickness and are less likely to undergo sentinel lymph node biopsy for lesions warranting this procedure per treatment guidelines.[2,5] In a study from Sweden, more advanced stage and shorter survival were observed in men living alone compared to those living with a partner,[4] whereas women did not show similar trends. In an earlier study from the United States in the period from 1973 to 2006, advanced melanoma was more prevalent among unmarried patients, particularly men.[6] Similarly, among patients older

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than 65 years, widowed patients were diagnosed at later stages and had worse survival.[7]

Overall, prior studies established an association between marital status and stage at diagnosis. Nevertheless, it is unknown whether this association is influenced by anatomic site, especially for an often visually recognizable cancer such as melanoma. Most melanomas are self-detected, and men had more melanoma sites that were not easily visible in a Spain-based population.[8] Additionally, in a previous Surveillance, Epidemiology, and End Results (SEER) study, certain anatomic sites had an increased risk of diagnosis at a later stage.[6] The association between marital status and overall survival and stage-specific survival is largely unknown as well, especially in the US population younger than 65 years. Such an association was observed in men in a Swedish population, without stratification by stage. In addition, many of the studies to date did not include patients from all stages of melanoma.

CAPSULE SUMMARY

- Advanced melanoma is more prevalent among unmarried patients across anatomic sites, including those readily visible, such as the face. The risk is highest in those age 18 to 68 years and in men.
- Unmarried patients, especially men younger than 68 years, could benefit from closer screening and follow-up than their married counterparts.

This study comprehensively analyzes adult patients with invasive melanoma of all stages in the period from 2010 to 2016 using the SEER database.[9] Tumors are stratified by anatomic location to determine if an association between marital status and stage exists across different anatomic sites. We also probe the association between marital status and survival within each stage in men and women. Finally, this study investigates how national trends compare to those observed at Johns Hopkins.

METHODS

Data acquisition and study design

This retrospective cohort study was approved by the institutional review board at Johns Hopkins University. Data from the SEER database were obtained for the years 2010 through 2016.[9] Analysis was performed on patients 18 years or older of all races with histologically confirmed invasive melanoma and known marital status and melanoma stage. For patients with more than 1 melanoma, the index tumor was used. The Johns Hopkins data for the years 2003 through 2017 were obtained from the Sidney Kimmel Comprehensive Cancer Center registry. Patients of all races with cutaneous melanoma who were 18 years or older with known stage (including melanoma in situ) and marital status were included. Because Maryland is not a contributing state to the SEER registry, Johns Hopkins cases are not included in the SEER database.

Statistical analysis

For the Johns Hopkins registry data, 1-way analysis of variance was used to test the differences of age at diagnosis across marital status groups (married, single, divorced, and widowed). The chi-square test or Fisher's exact test was conducted, depending on the sample size in subgroups, to compare other categorical demographic and clinical characteristics across marital status groups. For the SEER data, 1-way analysis of variance was used to test the difference of age across marital status groups, and the chi-square test was used to compare other categorical variables.

The association between marital status and stage was assessed by using prevalence ratios. Early stages (I or II in the SEER cohort and 0-II in the Johns Hopkins cohort) were grouped as localized disease, and stages III and IV were grouped as advanced disease. Because the prevalence of advanced stages was greater than 10%, log binomial regression was conducted to assess prevalence ratios. When log binomial regression failed to converge, Poisson regression with robust variance was used as an approximation. For Johns Hopkins registry data, we regressed binary melanoma stage against categorical marital status (4 groups), adjusting for sex, race, and continuous age. For SEER data, we conducted analyses stratified by sex, age tertile, combination of sex and anatomic site, and combination of age tertile and anatomic site.

Hazard ratios with 95% confidence intervals for the association between marital status and overall survival were estimated by using Cox proportional hazard regression. For Johns Hopkins data, regressions were adjusted for sex, race, stage, and continuous age. Schoenfeld residuals were calculated to test for violation of the proportional hazard (PH) assumption. There was evidence of nonproportionality for age and stage; therefore, our analyses were stratified by stage of melanoma, categorized as advanced (stages III and IV) and localized (stages 0-II). Alternatively, we added an interaction term between age and stage with follow-up time to relax

Abbreviations used:

PH: proportional hazard
SEER: Surveillance, Epidemiology, and End Results

the PH assumption. For SEER data, Cox regression within each sex and stage stratum was conducted. Patients contributed person-time from the date of diagnosis until the date of death or date of last visit, whichever came first. We also calculated the cancer-specific hazard ratios overall and within each sex by treating deaths due to causes other than the index melanoma as censored events. Because of the large sample size of SEER data, we checked the PH assumption by plotting the Schoenfeld residuals instead of performing a statistical test, and we did not observe major violations within each stratum. All analyses were performed in R software, version 3.6.1 (R Core Team, Vienna, Austria) and Stata, version 15 (StataCorp, College Station, TX). Two-sided *P* values less than .05 were considered statistically significant.

RESULTS

SEER database

Demographic and clinical characteristics. In the national cohort, 68.5% of patients were married (Table I). Men constituted 57.4% of the population and were overrepresented among married patients. Single patients were younger than married patients. The vast majority of patients (98.5%) were white, regardless of marital status. Married patients were less likely to present with regional or metastatic disease. Married, single, and divorced patients were comparable in anatomic sites and histologic subtypes but differed significantly from widowed patients, whose tumors were more likely to be on the face and of the nodular and lentigo maligna subtypes. Married patients were also less likely to present with ulcerated tumors.

Marital status and stage in both sexes across anatomic sites. The results in Table I suggest that married patients were less likely to present in advanced stages. Next, patients were stratified by sex and anatomic site, and log binomial regression adjusting for age and race was conducted to measure the association between marital status and stage (Table II). Married patients of both sexes were less likely to present in advanced stages, and this was consistent across anatomic sites. This trend was more pronounced among men. Importantly, unmarried women with melanoma on the face were not significantly different from married women.

Marital status and stage in different age groups across anatomic sites. To determine whether age influences the association between marital status and stage, patients were stratified into 3 tertiles (18-54, 55-68, and >68 years old). Unmarried patients in all age groups were more likely to be diagnosed with advanced melanoma. This association was strongest in the youngest and middle age tertiles, and this held true for most anatomic sites (Table III).

Marital status and overall survival in men and women. Unmarried patients of both sexes experienced shorter survival than married patients regardless of melanoma stage (Table IV). In early disease where mortality is rarely cancer related, the association between marital status and mortality was stronger among women than in men. In more advanced stages, unmarried men and women were equally at increased risk (Table IV). Concordantly, cancer-specific mortality was higher in unmarried patients of both sexes (Supplementary Table I; available via Mendeley at https://doi.org/10.17632/rrp9njb7fj.1).

Johns Hopkins database

Demographic and clinical characteristics. Given that the national SEER registry includes patients pooled from numerous health care centers, we investigated whether the advantage associated with marriage—earlier stage and improved survival—held true in a tertiary care center. The majority of patients at Johns Hopkins were either married or single (Supplementary Table II; available via Mendeley at https://doi.org/10.17632/rrp9njb7fj.1). These groups represented a larger proportion than in the SEER database, with a diminished proportion of divorced and widowed patients. Similar to the SEER data, men were overrepresented. Single patients were younger on average, and the vast majority were white. Smoking status and alcohol use were largely comparable between married and single patients. Divorced patients were more likely to be previous or current smokers. Similar to the national data, married patients were less likely to be diagnosed in stages III and IV. The trunk was the most common site of melanoma in all patient groups except widowed patients, whose most common site was the face, consistent with their older age. Concordantly, widowed patients were more likely to have lentigo maligna tumors, which have predilection for the face. Treatment modalities were comparable across different groups (Supplementary Table II).

Marital status and stage at diagnosis. Single and divorced patients at our institution were more likely to present in advanced stages than married patients, in concordance with the national data. This

Table I. SEER baseline patient and tumor characteristics by marital status

Characteristics	Single (n = 12,081; 16.4%)	Married (n = 50,363; 68.5%)	Divorced (n = 5631; 7.7%)	Widowed (n = 5483; 7.5%)	*P* value	Total (N = 73,558)
Sex, n (%)						
Male	6560 (54.3)	31,043 (61.6)	2762 (49.0)	1894 (34.5)	<.001	42,259 (57.4)
Female	5521 (45.7)	19,320 (38.4)	2869 (51.0)	3589 (65.5)		31,299 (42.6)
Age, y						
Mean (SD)	51.2 (17.5)	60.6 (14.3)	60.9 (12.6)	78.4 (11.0)	<.001	60.4 (15.8)
Median (range)	53.0 (19.0-100)	61.0 (19.0-101)	61.0 (22.0-98.0)	80.0 (26.0-104)		61.0 (19.0-104)
Race, n (%)						
White	11,820 (97.8)	49,741 (98.8)	5535 (98.3)	5369 (97.9)	<.001	72,465 (98.5)
Black	110 (0.9)	164 (0.3)	38 (0.7)	47 (0.9)		359 (0.5)
Other	151 (1.2)	458 (0.9)	58 (1.0)	67 (1.2)		734 (1.0)
Stage, n (%)						
1	8051 (66.6)	36,721 (72.9)	3572 (63.4)	3113 (56.8)	<.001	51,457 (70.0)
2	1785 (14.8)	6988 (13.9)	930 (16.5)	1511 (27.6)		11,214 (15.2)
3	1439 (11.9)	4520 (9.0)	718 (12.8)	515 (9.4)		7192 (9.8)
4	806 (6.7)	2134 (4.2)	411 (7.3)	344 (6.3)		3695 (5.0)
Anatomic site						
Face	1168 (9.7)	5921 (11.8)	555 (9.9)	953 (17.4)	<.001	8597 (11.7)
Lower limb and hip	2362 (19.6)	9036 (17.9)	1133 (20.1)	1045 (19.1)		13,576 (18.5)
Scalp and neck	922 (7.6)	4421 (8.8)	385 (6.8)	513 (9.4)		6241 (8.5)
Skin NOS	588 (4.9)	1935 (3.8)	317 (5.6)	270 (4.9)		3110 (4.2)
Trunk	4182 (34.6)	16,343 (32.5)	1759 (31.2)	1143 (20.8)		23,427 (31.8)
Upper limb and shoulder	2859 (23.7)	12,707 (25.2)	1482 (26.3)	1559 (28.4)		18,607 (25.3)
Histology						
Nodular	1194 (9.9)	4061 (8.1)	616 (10.9)	714 (13.0)	<.001	6585 (9.0)
Lentigo maligna	398 (3.3)	2875 (5.7)	244 (4.3)	436 (8.0)		3953 (5.4)
Superficial spreading	3919 (32.4)	16,607 (33.0)	1742 (30.9)	1358 (24.8)		23,626 (32.1)
Acral lentiginous	172 (1.4)	569 (1.1)	76 (1.3)	105 (1.9)		922 (1.3)
Regressing	16 (0.1)	73 (0.1)	9 (0.2)	5 (0.1)		103 (0.1)
Desmoplastic	114 (0.9)	665 (1.3)	73 (1.3)	88 (1.6)		940 (1.3)
Other	6268 (51.9)	25,513 (50.7)	2871 (51.0)	2777 (50.6)		37,429 (50.9)
Surgery						
No	801 (6.6)	2504 (5.0)	402 (7.1)	408 (7.4)	<.001	4115 (5.6)
Unknown	18 (0.1)	68 (0.1)	8 (0.1)	9 (0.2)		103 (0.1)
Yes	11,262 (93.2)	47,791 (94.9)	5221 (92.7)	5066 (92.4)		69,340 (94.3)
Ulceration						
Absent	9333 (77.3)	41,083 (81.6)	4186 (74.3)	3780 (68.9)	<.001	58,382 (79.4)
Present	2006 (16.6)	6933 (13.8)	1064 (18.9)	1389 (25.3)		11,392 (15.5)
Unknown	742 (6.1)	2347 (4.7)	381 (6.8)	314 (5.7)		3784 (5.1)
Mitotic rate						
Mitosis absent	3352 (27.7)	15,307 (30.4)	1461 (25.9)	1221 (22.3)	<.001	21,341 (29.0)
Mitosis present	5106 (42.3)	20,623 (40.9)	2519 (44.7)	2701 (49.3)		30,949 (42.1)
Unknown	3623 (30.0)	14,433 (28.7)	1651 (29.3)	1561 (28.5)		21,268 (28.9)

NOS, Not otherwise specified; *SEER*, Surveillance, Epidemiology, and End Results.

association was stronger among men; women displayed a similar trend, but it did not reach statistical significance (Table V). Data among widowed patients did not reach statistical significance either. Upon stratifying cases by anatomic site (Table VI), unmarried patients overall either showed higher likelihood of advanced disease or the trend did not reach statistical significance, possibly because of the smaller sample size.

Marital status and survival. We then investigated whether unmarried patients at our institution also had shorter overall survival, similar to the national trends. Stratified analysis by sex was not possible because of the limited sample size. Here,

Table II. SEER data: Prevalence ratios for the association between marital status and stage (III or IV vs I or II) by anatomic site and sex

	All				Trunk			
	Male		Female		Male		Female	
Marital status	Prevalence ratio* (95% CI)	*P* value	Prevalence ratio* (95% CI)	*P* value	Prevalence ratio* (95% CI)	*P* value	Prevalence ratio* (95% CI)	*P* value
Married (reference)	1		1		1		1	
Single	1.45 (1.37-1.53)	<.001	1.28 (1.18-1.39)	<.001	1.56 (1.41-1.72)	<.001	1.4 (1.19-1.64)	<.001
Divorced	1.69 (1.58-1.81)	<.001	1.39 (1.26-1.53)	<.001	1.92 (1.69-2.18)	<.001	1.27 (1.03-1.58)	.029
Widowed	1.29 (1.16-1.43)	<.001	1.29 (1.16-1.42)	<.001	1.42 (1.14-1.78)	.002	1.17 (0.91-1.5)	.213
	Upper limb and shoulder				Face			
Married (reference)	1		1		1		1	
Single	1.61 (1.38-1.87)	<.001	1.25 (1.02-1.53)	.031	1.4 (1.12-1.76)	.003	1.46 (0.96-2.23)	.078
Divorced	1.64 (1.34-2.01)	<.001	1.33 (1.05-1.7)	.02	1.39 (1-1.92)	.048	1.59 (0.92-2.73)	.095
Widowed	1.48 (1.13-1.93)	.004	1.37 (1.07-1.76)	.013	1.45 (1.02-2.05)	.036	1.41 (0.86-2.29)	.17
	Scalp and neck				Lower limb and hip			
Married (reference)	1		1		1		1	
Single	1.28 (1.05-1.55)	.014	1.4 (0.99-1.99)	.06	1.37 (1.18-1.59)	<.001	1.27 (1.09-1.48)	.002
Divorced	1.79 (1.42-2.27)	<.001	1.58 (1.04-2.4)	.033	1.78 (1.49-2.13)	<.001	1.45 (1.21-1.74)	<.001
Widowed	1.04 (0.74-1.46)	.82	1.31 (0.87-1.96)	.194	1.36 (1.01-1.84)	.046	1.49 (1.24-1.79)	<.001
	Skin NOS							
Married (reference)	1				1			
Single	1 (0.98-1.03)	.907			0.99 (0.94-1.05)	.738		
Divorced	1.02 (1-1.04)	.06			1.01 (0.95-1.06)	.841		
Widowed	0.96 (0.91-1.02)	.177			0.98 (0.93-1.03)	.38		

CI, Confidence interval; *NOS*, not otherwise specified; *SEER*, Surveillance, Epidemiology, and End Results.
*Prevalence ratio is adjusted for age and race by using multivariable analysis.

too, single patients experienced shorter overall survival than married patients after adjustment for age, sex, race, and stage (hazard ratio; 1.51; 95% confidence interval, 1.15-1.99). Widowed patients followed the same trends, but for divorced patients, this did not reach statistical significance (Supplementary Table III; available via Mendeley at https://doi.org/10.17632/rrp9njb7fj.1).

DISCUSSION

This study shows that married patients with cutaneous melanoma in the United States present at earlier stages than their unmarried counterparts. This trend was observed in both men and women, although male patients were at higher risk for later presentation. Importantly, this correlation persisted among all adult age groups and regardless of anatomic location, including the face, which is readily visible to the patient and less dependent on visualization by a partner. Regardless of stage and sex, unmarried patients with melanoma experienced shorter overall survival. Data from our institution largely followed similar trends, but the smaller sample size did not allow for stratified analysis.

SEER patients included in this study were diagnosed between 2010 and 2016, showing persistent disparities by marital status similar to those seen in an earlier study of patients in the 1973 to 2006 period. To our knowledge, this is the first study to stratify patients by anatomic location, which is relevant in a visible cancer such as melanoma. Our data also show that this disparity persists across different age groups. However, among patients in the oldest tertile (>68 years), marital status had a weaker influence on stage at diagnosis, possibly because older patients are more likely to be followed by health care providers for various indications, providing an opportunity for earlier recognition of skin tumors and referral to a specialist.

This study suggests that the protective role of marriage is attributed to factors beyond visual recognition of melanoma by the spouse. Direct visualization by a partner did not seem to play a large role, because easily visible sites, such as the face, showed a similar impact of marital status on stage as other anatomic sites. This is supported by the similar trends seen with other cancers. In lung cancer, unmarried patients displayed worse

Table III. SEER data: Prevalence ratios for the association between marital status and stage (III or IV vs I or II) by anatomic site and age

	All						Trunk					
	Lowest tertile*		Middle tertile*		Highest tertile*		Lowest tertile*		Middle tertile*		Highest tertile*	
Marital status	Prevalence ratio† (95% CI)	*P* value	Prevalence ratio† (95% CI)	*P* value	Prevalence ratio† (95% CI)	*P* value	Prevalence ratio† (95% CI)	*P* value	Prevalence ratio† (95% CI)	*P* value	Prevalence ratio† (95% CI)	*P* value
Married (reference)	1		1		1		1		1		1	
Single	1.37 (1.28-1.47)	<.001	1.54 (1.43-1.66)	<.001	1.27 (1.15-1.4)	<.001	1.34 (1.18-1.51)	<.001	1.77 (1.54-2.04)	<.001	1.66 (1.35-2.04)	<.001
Divorced	1.76 (1.6-1.94)	<.001	1.63 (1.49-1.78)	<.001	1.31 (1.17-1.47)	<.001	1.66 (1.38-1.99)	<.001	1.74 (1.46-2.07)	<.001	1.7 (1.35-2.14)	<.001
Widowed	1.95 (1.47-2.58)	<.001	1.67 (1.44-1.94)	<.001	1.2 (1.1-1.31)	<.001	1.12 (0.53-2.38)	.768	1.66 (1.2-2.3)	.002	1.42 (1.15-1.76)	.001
	Upper limb and shoulder						Face					
Married (reference)	1		1		1		1		1		1	
Single	1.45 (1.2-1.75)	<.001	1.52 (1.23-1.88)	<.001	1.35 (1.04-1.76)	.023	1.41 (1-1.98)	.048	1.44 (1.03-2.01)	.034	1.38 (0.93-2.04)	.106
Divorced	1.58 (1.18-2.11)	.002	1.79 (1.42-2.26)	<.001	1.17 (0.86-1.59)	.327	1.41 (0.76-2.62)	.273	1.26 (0.8-1.98)	.323	1.62 (1.06-2.48)	.027
Widowed	1.79 (0.84-3.84)	.133	1.96 (1.33-2.87)	.001	1.19 (0.95-1.49)	.131	3.47 (1.35-8.93)	.01	2.76 (1.61-4.75)	<.001	1.21 (0.86-1.71)	.282
	Scalp and neck						Lower limb and hip					
Married (reference)	1		1		1		1		1		1	
Single	1.27 (0.96-1.67)	.091	1.53 (1.17-2.01)	.002	1.02 (0.69-1.51)	.927	1.26 (1.07-1.48)	.005	1.45 (1.21-1.75)	<.001	1.12 (0.87-1.45)	.382
Divorced	2.09 (1.42-3.09)	<.001	1.62 (1.15-2.26)	.005	1.49 (1.03-2.15)	.034	2.06 (1.69-2.52)	<.001	1.46 (1.17-1.82)	.001	1.26 (0.98-1.63)	.068
Widowed	3.03 (1.68-5.47)	<.001	1.34 (0.73-2.46)	.352	1 (0.74-1.37)	.988	1.4 (0.58-3.4)	.453	1.58 (1.11-2.26)	.011	1.33 (1.1-1.61)	.004
	Skin NOS											
Married (reference)	1			1			1					
Single	1.01 (0.98-1.04)		.651	1.01 (0.98-1.05)		.539	0.97 (0.92-1.02)		.291			
Divorced	0.99 (0.93-1.04)		.609	1.04 (1.01-1.08)		.004	1 (0.95-1.05)		.98			
Widowed	1.07 (1.03-1.11)		<.001	1.02 (0.96-1.09)		.535	0.95 (0.91-1)		.062			

CI, Confidence interval; *NOS*, not otherwise specified; *SEER*, Surveillance, Epidemiology, and End Results.
*Prevalence ratio is adjusted for age, sex, and race by using multivariable analysis.
†Age tertiles: lowest tertile, 18 to 54 years; middle tertile, 55 to 68 years; highest tertile, >68 years.

Table IV. SEER data: Hazard ratios for the association between marital status and death by stage and sex

	Stage 1				Stage 2			
	Male		Female		Male		Female	
Marital status	Hazard ratio (95% CI)*	*P* value	Hazard ratio (95% CI)*	*P* value	Hazard ratio (95% CI)*	*P* value	Hazard ratio (95% CI)*	*P* value
Married (reference)	1		1		1		1	
Single	1.36 (1.18-1.57)	<.001	1.77 (1.44-2.17)	<.001	1.43 (1.24-1.66)	<.001	1.75 (1.42-2.16)	<.001
Divorced	1.93 (1.64-2.27)	<.001	1.55 (1.23-1.94)	<.001	1.29 (1.05-1.57)	.013	1.35 (1.05-1.74)	.018
Widowed	1.6 (1.4-1.84)	<.001	1.59 (1.35-1.88)	<.001	1.42 (1.23-1.64)	<.001	1.35 (1.13-1.61)	.001
	Stage 3				Stage 4			
Married (reference)	1		1		1		1	
Single	1.44 (1.25-1.65)	<.001	1.3 (1.02-1.64)	.03	1.42 (1.26-1.6)	<.001	1.41 (1.17-1.71)	<.001
Divorced	1.53 (1.3-1.81)	<.001	1.42 (1.09-1.83)	.009	1.21 (1.04-1.41)	.015	1.26 (0.99-1.59)	.057
Widowed	1.31 (1.04-1.63)	.019	1.45 (1.15-1.81)	.001	1.4 (1.14-1.71)	.001	1.27 (1.02-1.57)	.029

CI, Confidence interval; *SEER*, Surveillance, Epidemiology, and End Results.
*Hazard ratio is adjusted for age, sex, and race using multivariable analysis.

Table V. Johns Hopkins data: Prevalence ratios for the association between marital status and stage (III or IV vs 0-II) by sex*

	All		Male		Female	
Marital status	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value
Married (reference)	1		1		1	
Single	1.54 (1.21-1.94)	<.001	1.61 (1.21-2.15)	.001	1.44 (0.94-2.17)	.083
Divorced	1.64 (1.08-2.35)	.011	1.72 (1.07-2.77)	.026	1.42 (0.71-2.54)	.274
Widowed	1.53 (0.94-2.34)	.07	1.11 (0.51-2.4)	.8	1.7 (0.88-3.08)	.092

CI, Confidence interval.
*Log binomial regression adjusting for sex, race, and continuous age was used to calculate prevalence ratio. If the log binomial regression did not converge, Poisson regression with robust variance was used.

Table VI. Johns Hopkins data: Prevalence ratios for the association between marital status and stage (III-IV vs 0-II) by anatomic site

	Trunk		Upper Extremity		Lower Extremity		Face		Scalp and neck	
Marital status	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value	Prevalence ratio (95% CI)	*P* value
Married (reference)	1		1		1		1		1	
Single	1.35 (0.92-1.98)	.128	2.02 (1.2-3.39)	.008	1.54 (0.89-2.68)	.122	2.32 (1.1-4.88)	.027	1.09 (0.51-2.36)	.821
Divorced	2.04 (1.18-3.52)	.011	0.36 (0.05-2.57)	.309	2.3 (1.3-4.08)	.004	1.25 (0.18-8.81)	.821	0 (0-0)	0
Widowed	1.86 (0.78-4.45)	.16	0.58 (0.14-2.33)	.442	2.81 (1.19-6.65)	.019	2.4 (0.86-6.74)	.096	1.09 (0.28-4.2)	.897

CI, Confidence interval.
Log binomial regression adjusting for sex, race, and continuous age was used to calculate prevalence ratio. If the log binomial regression did not converge, Poisson regression with robust variance was used.

cancer-specific survival, and among unmarried patients, single patients had worse cancer-specific survival than divorced or widowed patients.[10] Another study showed improved overall and cancer-specific survival in married patients in non–small lung cancer.[11] In a comprehensive study including patients with breast, prostate, colorectal, lung, pancreas, liver, esophageal, ovarian, and head/neck cancers and non-Hodgkin lymphoma, married patients were uniformly less likely to be diagnosed

with metastatic disease, more likely to receive definitive therapy, and less likely to die of their disease than unmarried patients across all studied cancer types.[3] Concordant with our findings in melanoma, marriage was more protective in male than female patients across different cancer types.

Factors explaining the benefit seen with marriage include encouragement to seek medical attention, among other behavioral variables. For example, adherence to sunscreen use was more prevalent among married patients,[12] and marriage/having a life partner was associated with more adequate protection from sun exposure among outdoor runners.[13] Socioeconomic factors also play a role; favorable prognosis was observed in privately insured patients with breast cancer, who, in turn, were more likely to be married than those without private insurance.[14] Importantly, poorer prognosis has been observed among patients with lower socioeconomic status in a number of health conditions besides cancer, such as coronary artery disease, even in tax-financed health care systems such as in Denmark,[15] where income and employment status were associated with clinical outcomes. Moreover, married patients are more likely to adhere to medical treatments, which could potentially influence disease outcomes.[16] Marriage also provides a source of social support, which mitigates the psychological stress associated with cancer diagnosis.[17] This is particularly important because psychosocial support improves outcomes, or at least patient well-being, in cancer and other health conditions.[18-20]

This study has multiple limitations. First, the anatomic site listed as *trunk* includes the chest, abdomen, and back, which may confound the data, because the chest and abdomen are more visible than the back on a self-examination. Similarly, different areas on the listed body parts may have variances in visibility (ie, the dorsal aspect of the arm compared to the ventral aspect) that may make the visibility hypothesis more valid if data were further stratified into more specific body areas. Nevertheless, the face in our cohort is a reasonable internal control to address this limitation. Second, data on treatment modalities besides surgery were lacking in the SEER data set, but this information was available in the Johns Hopkins data set, which permitted for more detailed analysis. Third, prognostic factors such as smoking and alcohol consumption were not available in the SEER database. Our institutional data showed similar rates of never smokers between single and married patients, although single patients were more likely to be current smokers (Supplementary Table II). Finally, married and unmarried patients are different in many other aspects than the variables studied here. Therefore, this retrospective, observational study by definition harbors intrinsic limitations related to confounding variables not accounted for.

Overall, our findings expand on results from previous studies showing a favorable prognosis among married patients with cancer and show that unmarried status in melanoma is a poor prognostic factor regardless of the cancer anatomic site. It also shows the highest influence of marital status among young and middle-age patients and male patients. Importantly, this disadvantage among unmarried patients is not solely due to later detection of melanoma, because overall survival continues to be worse among unmarried patients within each stage group. In a prior study, the survival benefit associated with marriage outweighed the published benefit attributable to chemotherapy.[3] Identification of this high-risk population provides an opportunity to better address these patients and, ultimately, improve outcomes.

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