The impact of demographics, socioeconomics, and health care access on melanoma outcomes

Jose L. Cortez, MS,[a,b] Juan Vasquez, BA,[b] and Maria L. Wei, MD, PhD[a,b,c]
San Francisco, California

Disparities in melanoma care exist in the United States. Disparities in provider type, patient demographics, place of residence, insurance status, socioeconomic status, race/ethnicity, and age impact melanoma outcomes. Melanomas detected by dermatologists are thinner, at an earlier stage, and have better survival outcomes compared with detection by primary care providers or patients. Lower socioeconomic status, race/ethnicity, and place of residence are associated with decreased access to or use of dermatologists, or both, and more advanced melanomas at diagnosis. Additionally, uninsured and publicly insured individuals are more likely to present with late-stage melanomas, resulting in worse outcomes. This review provides a comprehensive overview of how structural and patient-level characteristics influence melanoma outcomes in order to inform clinical care and health care policy as it relates to addressing gaps in melanoma care. (J Am Acad Dermatol 2021;84:1677-83.)

Key words: access; ethnicity; health disparities; insurance; melanoma; outcomes; race.

During the last 20 years, the global incidence of melanoma has been steadily increasing.[1] Early diagnosis and treatment at the in situ stage reduces mortality[2]; melanoma is curable by surgical resection and the 5-year survival of locally invasive melanomas is 98% compared with 64% for regional metastases and 23% for distant metastases.[3] Despite these statistics, outcomes can differ depending on patient demographics, including race, age, place of residence, socioeconomic status (SES), and insurance status or type.[2] Health disparities in melanoma care exist in the United States (US), including limited access to or delayed dermatologic care, which negatively impact outcomes. We define health disparities as "a chain of events signified by a difference in (1) environment, (2) access to, use of, and quality of care, (3) health status, or (4) a particular health outcome that deserves scrutiny."[4] Here, we provide an overview of research that has examined factors—race/ethnicity, place of residence, SES, insurance status/type and age—that contribute to differences in melanoma outcomes, to inform clinical care and health care policy.

METHODS

The PubMed database was searched independently by 2 reviewers for studies published by March 2020 that documented health disparities in melanoma care (see Supplemental Material for the search term list, available via Mendeley at https://doi.org/10.17632/v5mgb963fm.1). Studies published in English were included if they reported assessing disparities in melanoma care due to provider type, patient demographics, place of residence, insurance type, SES, risk perception or disease awareness and if they reported on how these factors influenced melanoma incidence, staging at diagnosis, clinical management, or outcome. Studies were excluded if they were not peer reviewed, case series or case reports, had self-reported outcomes, or patients' age

was <18 years. Nonrandomized studies were graded using the Newcastle-Ottawa Scale. Individual lists were consolidated, differences were resolved by consensus, and a final study list was approved by both reviewers.

RESULTS
Race/ethnicity

Staging at diagnosis. The US incidence rate of melanoma among non-Hispanic Whites is estimated to be 26.6 per 100,000 people, and the incidence is estimated to be 4.7 per 100,000 for Hispanics, 1.4 per 100,000 for Asians, and 1.0 per 100,000 for non-Hispanic Blacks.[5] All racial/ethnic minorities present with more advanced melanomas and a greater proportion of stage IV diagnoses compared with their White counterparts.[6-9] One study documented increased odds ratios for stage IV melanoma at presentation among Hispanics (odds ratio [OR], 3.64; 95% confidence interval [CI], 2.65-5.00), African Americans (OR, 4.24; 95% CI, 2.49-7.22), American Indians (OR, 3.38; 95% CI, 0.84-13.59), and Asians (OR, 2.36; 95% CI, 1.39-4.00) compared with Whites.[8] Late-stage melanoma was found in 18% of Hispanic and 26% of African American individuals compared with 12% of White individuals.[9] Hispanics are 43% more likely to live in neighborhoods with greater numbers of late-stage melanoma diagnoses ($P < .001$).[10]

Differences in staging at diagnosis for racial/ethnic minorities, such as Blacks and Hispanics, were reported to occur irrespective of Medicare, Medicaid, private insurance, or uninsured status.[6] However, another study reported that Hispanics are more likely to have advanced disease with fee-for-service insurance (OR, 2.07; 95% CI, 1.36-3.16)[11] compared with non-Hispanic Whites, but this difference was not observed for health maintenance organization plans.[12] When insurance is controlled for, the poorer prognosis reported for acral melanomas (predominant melanoma type in people of color) is due to advanced stage at presentation, irrespective of race/ethnicity.[13]

Advanced diagnoses of melanoma for racial/ethnic minority groups may be attributed in part to differences in health care use or risk perception, or both. For example, emergency departments are more often used for dermatologic care among

CAPSULE SUMMARY

- This study reviews the patient-specific and structural features of melanoma care that negatively impact outcomes, including limited access to or delayed dermatologic care.

- An understanding of factors that affect melanoma outcomes can inform clinical practice and health care policy and can lead to improved detection and management of this aggressive malignancy.

African American (18.3%) and Hispanic patients (10.5%) than among White patients (5.9%).[14] Of patients who made an office visit to a dermatologist, 90.9% were White.[15] Thus, late melanoma diagnoses in African Americans and Hispanics may be partly driven by an initial evaluation in suboptimal (ie, emergency department) settings rather than by dermatologists. Additionally, racial/ethnic minorities have been shown to have less knowledge, lower risk perception, greater reluctance about performing a self-skin examination, and to be less engaged in preventive measures to minimize risk.[16-21]

Outcomes. Studies comparing ethnic minority patients' melanoma survival with that of Whites reported worse outcomes across all ethnic groups.[7,8,21-28] There is a 1.96- to 3.01-fold greater risk of disease-specific mortality in minorities compared with Whites.[8] Longer survival times were reported for White patients ($P < .05$) compared with Hispanics, Asian American/Pacific Islanders, and African Americans.[22] Of Hispanic Whites, 7.3% with melanoma died of melanoma-specific causes compared with 4.8% of non-Hispanic Whites.[29] The median survival of African American patients was 16 months after diagnosis of vulvar/vaginal melanoma and 124 months after diagnosis of cutaneous melanoma compared with 39 months and 319 months in non-Black patients, respectively.[28]

Worsened outcomes observed for racial/ethnic minorities with melanoma may be due to advanced presentation of disease at diagnosis,[30] likely a consequence of economic, social, and cultural barriers that disproportionately affect minority groups, such as low SES.[26] SES is linked to melanoma stage at diagnosis and outcome, as discussed below. Additionally, Asgari et al[13] reported that outcomes for acral melanoma (the predominant type in people of color) are not associated with race/ethnicity, suggesting that race-specific genetics may not play a role in the differential outcomes for different races.

Place of residence

Melanoma care. The incidence rate of melanoma is estimated to be 22.4 per 100,000 people living in rural areas compared with 21.8 per 100,000 people living in metropolitan settings.[31] Individuals living in rural environments are more likely to

---

Abbreviations used:

CI: confidence interval
OR: odds ratio
SES: socioeconomic status
US: United States

---

experience delays in obtaining a biopsy of their melanomas[32] and to undergo biopsy more frequently by primary care physicians rather than dermatologists (26.3%), compared with individuals in urban environments (17.7%).[33] The incidence of stage I and II melanomas is higher in urban regions, whereas the incidence of stage III and IV melanomas is higher in rural regions.[32] Living in rural areas may present barriers to care, such as lack of transportation, lack of medical care infrastructure, decreased overall physician density, and physician shortages.[34,35] Dermatologist density is 52 per 100,000 people in rural areas compared with 309 per 100,000 people in metropolitan areas.[34] Decreased dermatologist density may also explain the higher rate of emergency department use for dermatologic conditions in rural areas.[13]

Outcomes. Rural residence has been shown to negatively affect melanoma survival and be predictive of decreased cause-specific survival for melanoma (area under the receiver operating characteristic curve of 0.80).[24,36] An excess 5-year mortality ratio has also been shown in rural vs urban regions (OR, 1.49; 95% CI, 1.22-1.82).[33] Additionally, there is a 20% higher adjusted case-fatality rate in rural vs urban areas (hazard ratio, 1.20; 95% CI, 1.02-1.43). This difference is possibly associated to urban patients having better access to care and regular follow-up.[35]

Socioeconomic status

Stage at diagnosis. In 2018, the US poverty rate was 11.8% (38.1 million people).[37] Several studies noted that educational level, a surrogate for SES, is inversely related to melanoma tumor thickness at the time of diagnosis[30,38-40]; that is, individuals with higher educational level have thinner lesions than those with lower educational attainment.[10,33,41] In addition, a spatial analysis of geo-coded melanoma cases diagnosed in Florida from 1999 to 2008 found that for every 1% increase in poverty in an area's population, there was an associated 2% increase in late-stage melanoma diagnoses ($P < .001$).[42]

Outcomes. Lower SES is associated with decreased access to dermatologists, leading to decreased assessment, treatment, and ultimately,

increased mortality.[23,24,30,39,43] Lower SES populations have worsened survival rates compared with higher SES populations.[30,38,39,44]

Factors contributing to increased mortality among individuals with lower SES include decreased melanoma awareness, knowledge, risk perception, and increased likelihood of presenting with advanced disease.[43,45] In 2018, 22% of African American, 19% of Hispanic, and 24% of American Indian/Alaska Natives lived in poverty in the US, compared with 9% of White individuals[45]; these statistics link low SES to identification as racial/ethnic minorities. SES status is also associated with type of insurance coverage. In 2016, most individuals in the US living 100% below the poverty line (63.6%), below 138% (63.1%), and between 100% and 199% of poverty (55.9%) were publicly insured, whereas most individuals between 200% and 299% (66.2%), 300% and 399% (76.4%), and at or above 400% of poverty (86.6%) were privately insured.[46] Finally, 66% of individuals insured by Medicaid (the US public insurance program for low-income individuals and people with disabilities) are living at up to 200% or below the federal poverty level.[46]

INSURANCE STATUS AND TYPE

Access to melanoma care. Insurance type can delay access or prevent melanoma care. For example, patients with Medicaid insurance had a significantly increased likelihood of delay to surgery (delay of more than 6 weeks) for definitive therapeutic excision, compared with those insured by private insurance (risk ratio, 1.36; 95% CI, 1.09-1.70).[47] And in the US, insurance type can restrict access to innovative therapies: 40% of melanoma patients do not have access to such treatments.[48] Additionally, dermatologists have significantly decreased rates of acceptance of Medicaid insurance compared with private insurances, limiting access to dermatologic care for certain subsets of patients.[49-51]

No insurance. In 2018, 8.5% of the US population, or 27.5 million individuals, had no health insurance.[46] Uninsured individuals more often present with thicker tumors (OR, 2.19; 95% CI, 1.76-2.73) with presence of ulceration (OR, 1.64; 95% CI, 1.40-1.92)—a poor prognostic factor—compared with non-Medicaid insured.[52] Uninsured individuals are more likely to be diagnosed with a late-stage melanoma, with reported OR of 2.59 (95% CI, 1.37-4.90)[53] and, more recently, an OR of 2.3 (95% CI, 2.1-2.5).[6] Being uninsured is linked to higher melanoma-specific mortality rates compared with insured individuals.[23,54]

Insurance type. Differences in melanoma stage at diagnosis vary with insurance type. Individuals

enrolled in private health maintenance organizations, where care is provided by a network of linked providers, were less likely to be given a late-stage melanoma diagnosis than individuals enrolled in private fee-for-service insurance, where patients find their own providers (OR, 0.50; 95% CI, 0.31-0.81).[11,12] Individuals with public Medicaid insurance had a higher incidence of thicker melanomas (OR, 2.36; 95% CI, 1.91-2.91), more advanced staging (OR, 1.59; 95% CI, 1.37-1.85), and presence of ulceration (OR, 1.40; 95% CI, 1.19-1.63) at diagnosis compared with privately insured individuals and were more likely to be diagnosed with late-stage melanoma, with reported ORs of 3.3 (95% CI, 3.0-3.6) to 4.69 (95% CI, 1.90-11.56).[6,10,52,53,55,56] Furthermore, 59.7% of Medicaid recipients are members of ethnic/racial minority groups,[57] linking insurance type to racial disparities.

Time of insurance enrollment affects stage at diagnosis. Individuals enrolled in Medicaid the month of their melanoma diagnosis were almost 14-fold more likely to have late-stage disease compared with those not covered by Medicaid (OR, 13.64; 95% CI, 4.43-41.98).[58] Those enrolled 1 to 11 months before diagnosis were also more likely to have late-stage disease (OR, 2.77; 95% CI, 1.28-5.99).[58] The authors suggested that screening services provided through Medicaid are essential and that continuous enrollment allows for faster access, especially when compared with enrollment during the month of diagnosis.[58]

Outcomes. Individuals with all stages of melanoma on health maintenance organization plans have improved rates of survival (96.7 months) compared with individuals with private fee-for-service plans (70.3 months, *P* < .01).[12] Those who are Medicaid-insured (hazard ratio, 1.83; 95% CI, 1.65-2.04) or uninsured (hazard ratio, 1.63; 95% CI, 1.44-1.85; *P* < .001) have increased mortality compared with individuals non-Medicaid-insured individuals.[52] Recent gains in improved survival from treatment advances are isolated to those with private and Medicare insurance and are not seen in those with Medicaid insurance.[59]

Provider type

Dermatologists are more likely than patients or primary care practitioners to detect thinner melanomas[41,60] because of specialized training and experience in performing complete skin examinations.[61,62] Melanoma in situ is more often diagnosed in patients with established dermatologists (63.6%) vs patients without an established dermatologist (44.5%)[63]; similarly, late-stage melanoma was less common (OR, 0.63; *P* < .001) with recent

dermatologist evaluation.[64] Patients with established dermatologists had thinner (0.48 mm) invasive melanomas than those without established dermatologists (0.61 mm).[63] Additionally, melanomas identified by dermatologists were thinner compared with patient-identified melanomas, at 0.3 vs 0.6 mm (OR, 0.42; *P* = .04),[62] and had the lowest likelihood of delay to surgery, defined as the interval from biopsy to surgical excision (16% delayed) compared with non-dermatologist-biopsied melanomas (31% delayed).[65]

Outcomes. Patients who saw a dermatologist had a 10.2% mortality (OR, 0.69; 95% CI, 0.55-0.86) compared with 15.4% of those who did not (OR, 1.00). The mortality of patients who saw both their primary care provider and a dermatologist was 8.2% (OR, 0.59; 95% CI, 0.51-0.67), indicating that integrated care by primary care providers and dermatologists is optimal for improved melanoma outcomes.[66] In addition, increased primary care provider density is also beneficial for early-stage diagnosis.[67]

Access. Patients benefit from ready access to dermatologists. However, barriers to access exist, such as the national dermatologist density being below the recommended optimal level[68] exacerbated by the differences in dermatologist density between rural and urban centers and by dermatologists' differential insurance acceptance rates, as discussed above.[34,49-51]

PATIENT AGE

Time to treatment. Patients aged 85 years or older, with a melanoma incidence rate of 110 per 100,000 people, had a higher incidence of surgical delays longer than 1.5 months compared with patients younger than 65 years (OR, 1.28; 95% CI, 1.05-1.55), those with prior melanoma (OR, 1.20; 95% CI, 1.08-1.34), and those with increased co-morbidity burden (OR, 1.18; 95% CI, 1.09-1.27).[64] Among patients older than 85 years, delays were often longer than 3 months, twice that of the younger group, and delays in biopsy of lesions suspicious for melanoma led to delays in therapeutic excision.[64] The observed disparate care for elderly patients is likely not insurance related, because there is no identified problem with Medicare acceptance by dermatology practices compared with Medicaid.[51] Surveyed adults aged older than 75 were more likely to report less worry about developing skin cancer, reported lack of clarity on prevention strategies, and were more likely to believe not much can be done to prevent skin cancer.[16] Prediagnosis awareness of melanoma was also poor in older men.[41,69]

CONCLUSION

Many factors influence disparities in melanoma outcomes. Care by a dermatologist is critical for earlier detection and improved outcomes. Lower SES occurs more frequently in racial minorities and can limit access to dermatologic care by impacting both insurance status/type and place of residence. Delays in care also contribute to worse outcomes in minority groups and are influenced by disparate health care use and melanoma risk assessment by minority groups. Increased awareness of disparities in melanoma care can guide practitioners and future policy changes to help increase access to melanoma care among vulnerable populations. Access to specialty care continues to be a relevant discourse as public health insurance becomes more widely available and the US population becomes more diverse. Increasing the number of trained dermatologists and advanced practice providers (eg, nurse practitioners and physician assistants)[70] and future widespread deployment of technology, such as teledermatology or skin screening mobile device apps, aided by artificial intelligence diagnostic support, could assist in closing the gaps in melanoma care.[34,71,72]

REFERENCES

1. GLOBOCAN. *Cancer Incidence, Mortality, and Prevalence.* 2018.
2. National Comprehensive Cancer Network. *Clinic Practice Guidelines in Oncology, Cutaneous Melanoma, Version 2.2020.* 2019. Available at: https://www.nccn.org/professionals/physician_gls/pdf/cutaneous_melanoma.pdf
3. American Cancer Society. Melanoma Skin Cancer. Early Detection, Diagnosis and Staging: Survival Rates for Melanoma Skin Cancer. 2019. Accessed December 10, 2019. Available at: https://www.cancer.org/content/cancer/en/cancer/melanoma-skin-cancer/detection-diagnosis-staging/survival-rates-for-melanoma-skin-cancer-by-stage.html#references
4. Carter-Pokras O, Baquet C. What is a "health disparity"? *Public Health Rep.* 2002;117(5):426.
5. Howlader N, Noone AM, Krapcho M, et al., eds. *SEER Cancer Statistics Review, 1975-2016. National Cancer Institute.* 2019. Accessed April 12, 2020. Available at: https://seer.cancer.gov/csr/1975_2016/
6. Halpern MT, Ward EM, Pavluck AL, Schrag NM, Bian J, Chen AY. Association of insurance status and ethnicity with cancer stage at diagnosis for 12 cancer sites: a retrospective analysis. *Lancet Oncol.* 2008;9(3):222-231.
7. Stubblefield J, Kelly B. Melanoma in non-Caucasian populations. *Surg Clin North Am.* 2014;94(5):1115-1126.
8. Cormier JN, Xing Y, Ding M, et al. Ethnic differences among patients with cutaneous melanoma. *Arch Inter Med.* 2006; 166(17):1907.
9. Hu S, Parmet Y, Allen G, et al. Disparity in melanoma. *Arch Dermatol.* 2009;145(12). https://doi.org/10.1001/archdermatol.2009.302.
10. Hu S, Sherman R, Arheart K, Kirsner RS. Predictors of neighborhood risk for late-stage melanoma: addressing disparities through spatial analysis and area-based measures. *J Investig Dermatol.* 2014;134(4):937-945.
11. Rouhani P, Arheart KL, Kirsner RS. Differences in melanoma outcomes among Hispanic Medicare enrollees. *J Am Acad Dermatol.* 2010;62(5):768-776.
12. Kirsner RS, Wilkinson JD, Ma F, Pacheco H, Federman DG. The association of Medicare health care delivery systems with stage at diagnosis and survival for patients with melanoma. *Arch Dermatol.* 2005;141(6):1279-1284.
13. Asgari MM, Shen L, Sokil MM, Yeh I, Jorgenson E. Prognostic factors and survival in acral lentiginous melanoma. *Br J Dermatol.* 2017;177(2):428-435.
14. Abokwidir M, Davis SA, Fleischer AB, Pichardo-Geisinger RO. Use of the emergency department for dermatologic care in the United States by ethnic group. *J Dermatolog Treat.* 2015; 26(4):392-394.
15. Nelson C. Office visits to dermatologists: National Ambulatory Medical Care Survey, United States, 1989-90. *Adv Data.* 1994; (240):1-12.
16. Buster KJ, You Z, Fouad M, Elmets C. Skin cancer risk perceptions: a comparison across ethnicity, age, education, gender, and income. *J Am Acad Dermatol.* 2012;66(5):771-779.
17. Korta DZ, Saggar V, Wu TP, Sanchez M. Racial differences in skin cancer awareness and surveillance practices at a public hospital dermatology clinic. *J Am Acad Dermatol.* 2014;70(2): 312-317.
18. Pipitone M, Robinson JK, Camara C, et al. Skin cancer awareness in suburban employees: a Hispanic perspective. *J Am Acad Dermatol.* 2002;47(1):118-123.
19. Weiss J, Kirsner RS, Hu S. Trends in primary skin cancer prevention among US Hispanics: a systematic review. *J Drugs Dermatol.* 2012;11(5):580-586.
20. Ma F, Collado-Mesa F, Hu S, Kirsner RS. Skin cancer awareness and sun protection behaviors in white Hispanic and white non-Hispanic high school students in Miami, Florida. *Arch Dermatol.* 2007;143(8):983-988.
21. Andreeva VA, Cockburn MG. Cutaneous melanoma and other skin cancer screening among Hispanics in the United States: a review of the evidence, disparities, and need for expanding the intervention and research agendas. *Arch Dermatol.* 2011; 147(6):743.
22. Dawes SM, Tsai S, Gittleman H, Barnholtz-Sloan JS, Bordeaux JS. Racial disparities in melanoma survival. *J Am Acad Dermatol.* 2016;75(5):983-991.
23. Buster KJ, Stevens EI, Elmets CA. Dermatologic health disparities. *Dermatol Clin.* 2012;30(1):53-59. viii.
24. Cheung MR. Using SEER data to quantify effects of low income neighborhoods on cause specific survival of skin melanoma. *Asian Pac J Cancer Prev.* 2013;14(5):3219-3221.
25. Harvey C, Oldfield CW, Chen JT, Eschbach K, Harvey VM. Melanoma disparities among US Hispanics: use of the social ecological model to contextualize reasons for inequitable outcomes and frame a research agenda. *J Skin Cancer.* 2017; 2016(1). https://doi.org/10.1155/2016/4635740.
26. Harvey VM, Patel H, Sandhu S, Wallington SF, Hinds G. Social determinants of racial and ethnic disparities in cutaneous melanoma outcomes. *Cancer Control.* 2014;21(4):343-349.
27. Goldenberg A, Vujic I, Sanlorenzo M, Ortiz-Urda S. Melanoma risk perception and prevention behavior among African-Americans: the minority melanoma paradox. *Clin Cosmet Investig Dermatol.* 2015;8:423-429.
28. Mert I, Semaan A, Winer I, Morris RT, Ali-Fehmi R. Vulvar/vaginal melanoma. *Int J Gynecol Cancer.* 2013;23(6):1118-1126.

29. Merrill RM, Pace ND, Elison AN. Cutaneous malignant melanoma among white Hispanics and non-Hispanics in the United States. *Ethn Dis*. 2010;20(4):353-358.

30. Zell JA, Cinar P, Mobasher M, Ziogas A, Meyskens FL, Anton-Culver H. Survival for patients with invasive cutaneous melanoma among ethnic groups: the effects of socioeconomic status and treatment. *J Clin Oncol*. 2008;26(1):66-75.

31. Blake KD, Moss JL, Gaysynsky A, Srinivasan S, Croyle RT. Making the case for investment in rural cancer control: an analysis of rural cancer incidence, mortality, and funding trends. *Cancer Epidemiol Biomarkers Prev*. 2017;26(7):992-997.

32. Strömberg U, Peterson S, Holmberg E, et al. Cutaneous malignant melanoma show geographic and socioeconomic disparities in stage at diagnosis and excess mortality. *Acta Oncol*. 2016;55(8):993-1000.

33. Green J, Murchie P, Lee AJ. Does patients' place of residence affect the type of physician performing primary excision of cutaneous melanoma in Northern Scotland? *J Rural Health*. 2013;29(s1):s35-s42.

34. Feng H, Berk-Krauss J, Feng PW, Stein JA. Comparison of dermatologist density between urban and rural counties in the United States. *JAMA Dermatol*. 2018;154(11):1265-1271.

35. Coory M, Smithers M, Aitken J, Baade P, Ring I. Urban-rural differences in survival from cutaneous melanoma in Queensland. *Aust N Z J Public Health*. 2006;30(1):71-74.

36. Chang AE, Karnell LH, Menck HR. The National Cancer Data Base report on cutaneous and noncutaneous melanoma: a summary of 84,836 cases from the past decade. The American College of Surgeons Commission on Cancer and the American Cancer Society. *Cancer*. 1998;83(8):1664-1678.

37. United States Census Bureau, Semega J, Kollar M, Creamer J, Mohanty A. Income and poverty in the United States: 2018. Report Number P60-266; 2019. Available at: https://www.census.gov/library/publications/2019/demo/p60-266.html. Accessed April 11, 2020.

38. Ortiz CAR, Goodwin JS, Freeman JL, Reyes-Ortiz CA, Goowin JS, Freeman JL. The effect of socioeconomic factors on incidence, stage at diagnosis and survival of cutaneous melanoma. *Med Sci Monit*. 2005;11(5):RA163-RA172.

39. Mavor ME, Richardson H, Miao Q, Asai Y, Hanna TP. Disparities in diagnosis of advanced melanoma: a population-based cohort study. *CMAJ Open*. 2018;6(4):E502-E512.

40. Escobedo LA, Crew A, Eginli A, Peng D, Cousineau MR, Cockburn M. The role of spatially-derived access-to-care characteristics in melanoma prevention and control in Los Angeles County. *Health Place*. 2017;45:160-172.

41. Swetter SM, Johnson TM, Miller DR, Layton CJ, Brooks KR, Geller AC. Melanoma in middle-aged and older men. *Arch Dermatol*. 2009;145(4):397-404.

42. Pollitt RA, Swetter SM, Johnson TM, Patil P, Geller AC. Examining the pathways linking lower socioeconomic status and advanced melanoma. *Cancer*. 2012;118(16):4004-4013.

43. Geller AC, Miller DR, Lew RA, Clapp RW, Wenneker MB, Koh HK. Cutaneous melanoma mortality among the socioeconomically disadvantaged in Massachusetts. *Am J Pub Health*. 1996;86(4):538-543.

44. Sitenga JL, Aird G, Ahmed A, Walters R, Silberstein PT. Socioeconomic status and survival for patients with melanoma in the United States: an NCDB analysis. *Int J Dermatol*. 2018;57(10):1149-1156.

45. The Kaiser Family Foundation. *Poverty by Race/Ethnicity*. 2019. Available at: https://www.kff.org/other/state-indicator/poverty-rate-by-raceethnicity/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.

46. United States Census Bureau, Barnett JC, Berchick ER. Health Insurance Coverage in the United States: 2016. Report Number P60-260. 2017. Available at: https://www.census.gov/library/publications/2017/demo/p60-260.html. Accessed April 11, 2020.

47. Adamson AS, Zhou L, Baggett CD, Thomas NE, Meyer A-M. Association of delays in surgery for melanoma with insurance type. *JAMA Dermatol*. 2017;153(11):1106-1113.

48. Kandolf Sekulovic L, Guo J, Agarwala S, et al. Access to innovative medicines for metastatic melanoma worldwide: Melanoma World Society and European Association of Dermato-oncology survey in 34 countries. *Eur J Cancer*. 2018;104:201-209.

49. Alghothani L, Jacks SK, vander Horst A, Zirwas MJ. Disparities in access to dermatologic care according to insurance type. *Arch Dermatol*. 2012;148(8):956.

50. Ferrara ML, Johnson DW, Elpern DJ. Cherry picking in the 'Aina: inequalities of access to dermatologic care in Hawai'i. *Hawaii J Med Public Health*. 2015;74(6):197-199.

51. Resneck J, Pletcher MJ, Lozano N. Medicare, Medicaid, and access to dermatologists: the effect of patient insurance on appointment access and wait times. *J Am Acad Dermatol*. 2004;50(1):85-92.

52. Amini A, Rusthoven CG, Waxweiler TV, et al. Association of health insurance with outcomes in adults ages 18 to 64 years with melanoma in the United States. *J Am Acad Dermatol*. 2016;74(2):309-316.

53. Roetzheim RG, Pal N, Tennant C, et al. Effects of health insurance and race on early detection of cancer. *J Natl Cancer Inst*. 1999;91(16):1409-1415.

54. Smith JK, Ng SC, Zhou Z, et al. Does increasing insurance improve outcomes for US cancer patients? *J Surg Res*. 2013;185(1):15-20.

55. Plascak JJ, Fisher JL, Paskett ED. Primary care physician supply, insurance type, and late-stage cancer diagnosis. *Am J Prev Med*. 2015;48(2):174-178.

56. Al-Qurayshi Z, Srivastav S, Wang A, et al. Disparities in the presentation and management of cutaneous melanoma that required admission. *Oncology*. 2018;95(2):69-80.

57. *Centers for Medicare and Medicaid Services CMS Statistics Reference Booklet*. 2016 Edition; 2016. Available at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/CMS-Statistics-Reference-Booklet/2016.html. Accessed July 30, 2017.

58. Pollitt RA, Clarke CA, Shema SJ, Swetter SM. California Medicaid enrollment and melanoma stage at diagnosis: a population-based study. *Am J Prev Med*. 2008;35(1):7-13.

59. Ellis L, Canchola AJ, Spiegel D, Ladabaum U, Haile R, Gomez SL. Trends in cancer survival by health insurance status in California From 1997 to 2014. *JAMA Oncol*. 2018;4(3):317.

60. Pennie ML, Soon SL, Risser JB, Veledar E, Culler SD, Chen SC. Melanoma outcomes for Medicare patients. *Arch Dermatol*. 2007;143(4):488-494.

61. Chiaravalloti AJ, Laduca JR. Melanoma screening by means of complete skin exams for all patients in a dermatology practice reduces the thickness of primary melanomas at diagnosis. *J Clin Aesthet Dermatol*. 2014;7(8):18-22.

62. Kantor J, Kantor DE. Routine dermatologist-performed full-body skin examination and early melanoma detection. *Arch Dermatol*. 2009;145(8):873-876.

63. Cheng MY, Moreau JF, McGuire ST, et al. Melanoma depth in patients with an established dermatologist. *J Am Acad Dermatol*. 2014;70(5):841-846.

64. Pitre LD, Linford G, Pond GR, McWhirter E, Seow H. Is access to care associated with stage at presentation and survival for melanoma patients? *J Cutan Med Surg*. 2019;23(6):586-594.

65. Lott JP, Narayan D, Soulos PR, Aminawung J, Gross CP. Delay of surgery for melanoma among Medicare beneficiaries. *JAMA Dermatol*. 2015;151(7):731.
66. Roetzheim RG, Lee J-H, Ferrante JM, et al. The influence of dermatologist and primary care physician visits on melanoma outcomes among Medicare beneficiaries. *J Am Board Fam Med*. 2013;26(6):637-647.
67. Fleming NH, Grade MM, Bendavid E. Impact of primary care provider density on detection and diagnosis of cutaneous melanoma. *PLoS One*. 2018;13(7):e0200097.
68. Glazer AM, Rigel DS. Analysis of trends in geographic distribution of us dermatology workforce density. *JAMA Dermatol*. 2017;153(5):472-473.
69. Schuurman MS, Hollestein LM, Bastiaannet E, et al. Melanoma in older patients: declining gap in survival between younger and older patients with melanoma. *Acta Oncol*. 2020;59(1):4-12.
70. Sargen MR, Shi L, Hooker RS, Chen SC. Future growth of physicians and non-physician providers within the U.S. dermatology workforce. *Dermatol Online J*. 2017;23(9):13030/qt 840223q6.
71. Porter ML, Kimball AB. Predictions, surprises, and the future of the dermatology workforce. *JAMA Dermatol*. 2018;154(11): 1253-1255.
72. Young AT, Xiong M, Pfau J, Keiser MJ, Wei ML. Artificial intelligence in dermatology: a primer. *J Investig Dermatol*. 2020;140(8):1504-1512.