SKIN

RESEARCH LETTER

Disparities in Melanoma Incidence Between Sex and Age Populations in the United States Between 2001 and 2021

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ABSTRACT

Introduction: This population-based study aimed to determine the incidence rates of melanoma in the U.S. and specifically assess the sex- and age-specific differences among different populations. Previous studies showed an increase in incidence of melanoma, but no clear sex-specific rates.
Methods: The United States Cancer Statistics (USCS) database, which covers 98% of the U.S. population, was used to identify patients with melanoma between 2001-2021. Melanoma incidence rates per 100,000 population were age-adjusted and calculated using SERR*Stat software and were stratified by sex and age into older and younger patients (age cutoff of 40 years). Time-trends (reported as annual percentage change “APC” and average APC “AAPC”) were estimated using Joinpoint regression via the modified weighted Bayesian Information Criteria method. Sex-specific trends were compared using the tests of parallelism and identicalness (P<0.05).
Results: Overall, there were 1,480,740 patients diagnosed with melanoma in the U.S. between 2001-2021. Melanoma incidence rates increased in men (AAPC=1.15; P<0.01) and women (AAPC=1.30; P<0.01). In older patients, incidence rates increased in men (AAPC=1.47; P<0.01) and women (AAPC=1.86; P<0.01) without significance (P=0.35). However, in younger patients (149,020 patients), melanoma incidence decreased in younger men (AAPC= -2.19%; P<0.01), but not in younger women (AAPC= - 0.54%; P<0.19). Sex-specific difference was significant with absolute AAPC value of 1.65 (P<0.01) and non-parallel non-identical trends (P-values<0.01).
Discussion: In summary, there was a decline in melanoma cases among men but no change among women with significant differences. This sparks the need for additional research to delve into the potential causes of these sex-based differences in cases of melanoma.

INTRODUCTION

The incidence of melanoma has been steadily increasing in developed, predominantly fair-skinned countries. Melanoma has risen over 320% since 1975 in the United States (US) alone, making it the fifth most common cancer in the country.[1] There are many treatment options for melanoma; however, medical care costs in the US are very high. Thus, primary preventive measures such as proper sun protection and secondary preventive measures such as regular skin screenings to detect and treat melanoma at early stages

not only reduce mortality but are also cost-effective.[2] Despite previous research, the incidence rates and changes over time of melanoma in different sex and age groups have yet to be clearly defined. To fill this gap, we conducted a comprehensive analysis to determine the melanoma incidence rates and trends in the US, focusing on identifying any significant differences between sex and age-specific groups over the past two decades.

METHODS

The United States Cancer Statistics (USCS) database, covering around 98% of the US population, was used to identify patients diagnosed with melanoma between 2001-2021. Melanoma cases were identified by selecting all histologically confirmed invasive melanoma diagnoses using International Classification of Disease for Oncology (ICD-O) codes 8720-8790/3, consistent with prior studies.[3] Melanoma incidence rates per 100,000 population were age-adjusted and calculated using SEER*Stat software and were stratified by sex and age into two groups: patients aged ≥40 years and those <40 years. Time-trends, reported as annual percentage change (APC) and average APC (AAPC) were estimated using Joinpoint regression via the modified weighted Bayesian Information Criteria method.[4] Sex-specific trends were compared using statistical tests of parallelism and coincidence (also known as identicalness) to assess whether trends differed in slope or overlapped, respectively. These tests, commonly applied in epidemiological trend analyses, were performed with a significance level of $P < 0.05$ was used.[5]

RESULTS

Overall, there were 1,480,740 patients diagnosed with melanoma in the US between 2001-2021 (41.6% females). Melanoma incidence rates increased over the 20-year period (2001–2021) in both males (AAPC = 1.15; $P < 0.01$) and females (AAPC = 1.30; $P < 0.01$) (**Figure 1 and Table 1**).In patients aged ≥40 years (1,331,744 patients), incidence rates were increasing in males (AAPC=1.47; $P<0.01$) and females (AAPC=1.86; $P<0.01$) without a significant difference ($P=0.35$) (**Figure 2**). However, in patients aged <40 years (149,020 patients), melanoma incidence decreased in younger males (AAPC= -2.19%; $P<0.01$), but not in younger females (AAPC= - 0.54%; $P<0.19$) (**Figure 3 and Table 1**). Sex-specific trends in melanoma incidence were compared using statistical tests of parallelism and identicalness (also known as coincidence). The test of parallelism evaluates whether two regression lines have the same slope, indicating if the trends change at the same rate over time. A significant result ($P < 0.05$) indicates the slope differ, meaning the trends are not parallel. The test of identicalness assesses whether the two trends are exactly the same line in terms of slope and intercept. A significant result indicates that the trends differ either in slope, intercepts, or both (i.e., they are not identical). These tests are widely used and validated in epidemiological l studies for comparing temporal trends.[4] In our analysis, sex-specific differences were significant, with an absolute average annual percent change (AAPC) of 1.65 ($P<0.01$), and both non-parallel and non-identical trends were observed (P-values < 0,01), indicating that incidence rate in younger males are decreasing at a significantly greater rate compared to relatively stable rates in females.

DISCUSSION

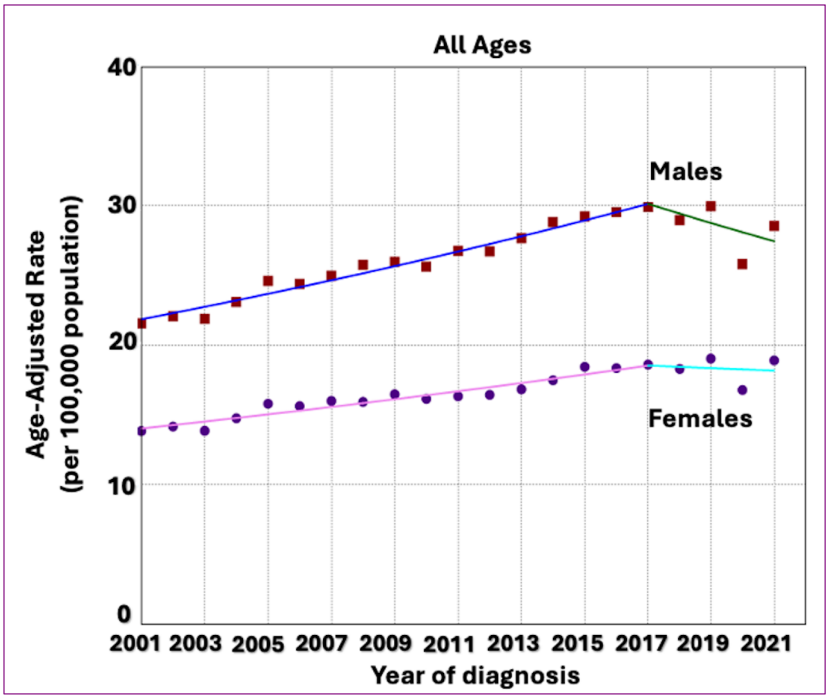

Figure 1. Sex-specific trends and incidence rates per 100,000 population for melanoma among all age groups in the U.S. from 2001 to 2021. Rates are age-adjusted. Incidence increased steadily in both males and females until around 2017, after which a decline is observed, particularly in male

Table 1: Trends in Melanoma Incidence by Age and Sex, 2001-2021: APC, AAPC, and Sex-Specific Differences

Age group, y	Cancer Cases (N= 1,480,764)[a]	Trends[b]			Sex-specific AAPC difference[c] (95% CI)	Pairwise comparison P-values		
		Time period	APC (95% CI)	AAPC (95% CI)		Sex-specific AAPC difference	Coincidence[d]	Parallelism[e]
All ages								
Males	864,209 (58.36%)	2001-2017	2.03* (1.63 to 2.43)	1.15* (0.55 to 1.74)	-0.16 (-1.05 to 0.73)	0.73	<0.01	<0.01
		2017-2021	-2.30 (-4.96 to 0.43)					
Females	616,555 (41.64%)	2001-2017	1.76* (1.32 to 2.19)	1.30 (0.65 to -1.97)				
		2017-2021	-0.48 (-3.51 to 2.64)					
Aged ≥40 years								
Males	810,493 (54.73%)	2001-2016	2.42* (1.97 to 2.88)	1.47* (0.92 to 2.03)		0.35	<0.01	<0.01

		2016-2021	-1.32 (-3.22 to 0.62)		-0.39 (-1.21 to 0.43)			
Females	521,251 (35.20%)	2001-2017	2.35* (1.94 to 2.76)	1.86* (1.25 to 2.48)				
		2017-2021	-0.07 (-2.85 to 2.79)					
Aged <40 years								
Males	53,716 (3.63%)	2001-2017	-1.54* (-1.98 to -1.09)	-2.19* (-2.99 to -1.38)	-1.65* (-2.79 to -0.51)	<0.01	<0.01	<0.01
		2017-2021	-4.75* (-8.57 to -0.77)					
Females	95,304 (6.44%)	2001-2005	2.62 (-1.30 to 6.70)	-0.54 (-1.33 to 0.27)				
		2005-2021	-1.31* (-1.78 to -0.84)					

[a] Data are presented as count numbers followed by percentages of the count numbers from the total cases of Melanoma in the database.
[b] Time-trends were computed using Joinpoint Regression Program (5.1.0.0) with 3 maximum joinpoints allowed (4-line segments).
[c] A negative value indicates a greater AAPC in females compared to males.
[d] Tests whether sex-specific trends were identical. A significant P-value indicates that the trends were not identical (i.e., they had different incidence rates and coincidence was rejected).
[e] Tests whether age-specific trends were parallel. A significant P-value indicates that the trends were not parallel (i.e., parallelism was rejected).
* Implies statistical significance

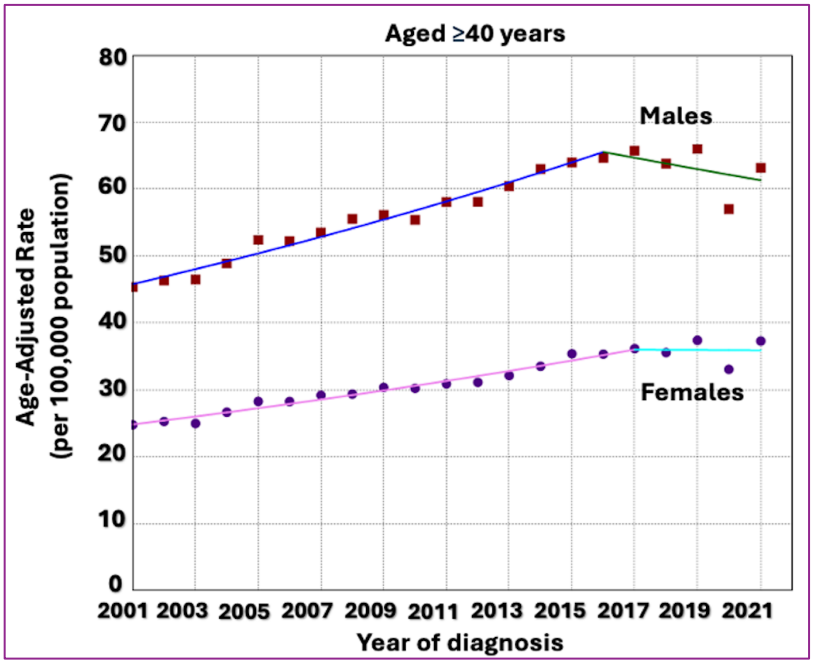

Figure 2. Sex-specific trend and incidence rates per 100,000 population for melanoma among adults Aged ≥40 years in the U.S. from 2001 to 2021. Rates are age-adjusted. Incidence increased steadily in both males and females until approximately 2017, after which rates declined in males while stabilizing in females

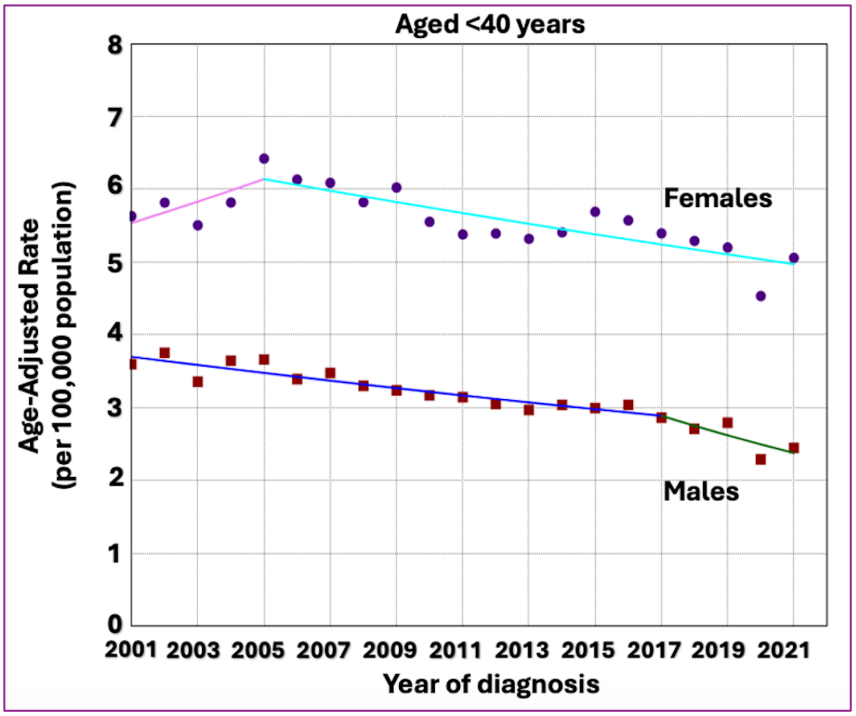

Figure 3. Sex-specific trends and incidence rates per 100,000 population for melanoma among adults aged <40 years in the U.S. from 2001-2021. Rates are age-adjusted. Incidence peaked in females around 2005-2007 before declining steadily, while incidence in males declined gradually throughout the study period

This comprehensive comparative analysis of data was collected from the US population database revealed trends in the occurrence of melanoma. Among individuals under 40 years old, there was a decline in melanoma incidence among males, while no significant change was observed among females.

While previous epidemiological studies revealed that females are more prone to melanoma than males in the younger adult population,[6] our analysis adds to the existing literature by providing evidence of no improvement in the burden of melanoma in younger females.

Our study is limited by the lack of risk factor data for melanoma in different populations; however, we highlight significant differences between age and sex groups and advocate the need for further research to uncover the underlying reasons behind the decline in melanoma cases among young males but not in counterpart females. Many factors play a role in these differences attributing to biological differences such as hormonal balance, genetic predispositions, and immune response or behavioral influences like variations in UV exposure, access to primary care, and awareness of preventive practices.[7] Our study highlights significant differences in melanoma incidence between sexes and age groups. These findings are important for informing targeted public health initiatives and guiding future research to better understand the underlying causes of these disparities.

Conflict of Interest Disclosures: None

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