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Article

Skin Cancer Mortality Trends Among Older Americans aged ≥65 years: A 25-Year Analysis (1999-2023)

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Simple Summary

Skin cancer deaths in Americans aged ≥65 years have continued to rise despite advances in treatment that may take years to yield population-wide benefits. We analyzed 25 years of U.S. nationwide death-certificate records to examine how mortality patterns have shifted and to identify which groups bear the greatest burden. Using data on all malignant melanoma and keratinocyte cancer deaths from 1999 to 2023, we mapped long-term trends and compared rates between men and women, rural and urban areas, and across racial and regional groups. In exploratory, descriptive analyses, we assessed whether temporal patterns coincided with the introduction of immune-checkpoint therapy around 2015 and with service disruptions during the COVID-19 pandemic, noting that these observations are hypothesis-generating rather than causal. Mortality rates rose again after a brief decline, with older men, residents of the West and South, and rural communities experiencing the highest burdens. These findings highlight priority targets for earlier detection, improved treatment access, and further research aimed at reducing persistent equity gaps.

Abstract

Background: Skin-cancer deaths among Americans aged ≥65 continue to rise despite immunotherapy and screening; monitoring mortality can guide prevention, early detection, and equitable care. **Methods:** We used CDC WONDER Multiple Cause-of-Death files (1999–2023) to identify malignant melanoma and keratinocyte cancers (ICD-10 C43–C44) among adults ≥65. Age-adjusted mortality rates (AAMRs) were standardized to the 2000 U.S. population. Joinpoint regression ($\alpha=0.05$; ≤ 4 joinpoint) estimated annual percent change (APC) overall and by sex, race/ethnicity, U.S. Census region, and 2013 urban–rural category. **Results:** Between 1999 and 2023, 249,811 skin-cancer deaths occurred among adults ≥65 years. The AAMR rose from 20.9 in 1999 to 25.3 in 2023 (1999–2014 APC: 1.12; 95% CI: 0.85–1.38), showed no significant change in 2014–2017 (APC: –2.93; 95% CI: –8.58 –3.07), then increased in 2017–2023 (APC: 2.42; 95% CI: 1.43–3.42), peaking in 2021 at 25.8 and remaining elevated through 2023. Men had higher AAMR than women (overall 37.4 vs 13.1 per 100,000); female rates were stable to 2019, then increased (2019–2023 APC: 3.06; 95% CI: 0.76–5.41). In 2023, AAMR was highest in non-Hispanic White adults (31.6), followed by Hispanic or Latino (7.9), non-Hispanic Black (4.5), and non-Hispanic Others (3.9). Race-specific trends: NH White increased pre-2014 and post-2017; Hispanic stable; NH Black declined to 2017 then showed no significant change in 2017–2023; NH Others declined modestly. AAMR varied by region (West 24.2; South 23.3; Midwest 22.2; Northeast 21.6), and nonmetropolitan areas had higher AAMR than metropolitan areas (25.0 vs 22.2). **Conclusions:** Skin-cancer mortality in Americans ≥65 remained elevated through 2023, peaking in 2021, with highest burdens in men, nonmetropolitan counties, and Western states. Because this is an observational analysis of combined C43/C44 deaths, any alignment of segments with therapy adoption or the pandemic is descriptive and hypothesis-generating, not causal. Targeted screening, sun-safety education, workforce incentives, and tele-dermatology outreach may help reduce the burden while drivers are clarified.

Keywords: skin cancer; melanoma; mortality trends; older adults; rural health; demographic disparities

Introduction

1.1. Background Context

Understanding skin cancer mortality patterns among older Americans has become increasingly urgent as this population grows and healthcare costs soar. Skin cancer poses a greater challenge to U.S. Medicare patients. It creates huge outpatient visit load and treatment costs[1,2]. Adults aged 65 and older make up an increasing share of skin-cancer deaths and this trend continues to increase [3]. While basal and squamous cell carcinomas occur most frequently in this older population, melanoma accounts for higher mortality rates due to its aggressive metastatic potential[4,5]. Global studies show that mortality in elderly population due to melanoma continues rising. By contrast, non-melanoma skin cancers haven't improved much since the 1990s [6–8].

From a public health perspective, studying melanoma and keratinocyte cancers together makes sense because both stem from UV damage and share similar prevention strategies. Since both cancer types develop after years of UV damage combined with late diagnosis, studying them together shows us exactly where prevention and treatment programs need the most attention. This combined approach gives us a complete picture of the skin cancer burden that healthcare planners need to address. Our study therefore analyzes combined C43–C44 mortality using Multiple Cause of Death (MCOD) data rather than underlying cause only, to capture the full UV-related mortality burden in adults ≥ 65 . Mortality patterns in the ≥ 65 population offer practical guidance for healthcare service planning. To our knowledge, no prior national study has integrated a 25-year series for combined melanoma and keratinocyte cancers with concurrent stratification by sex, race/ethnicity, region, and urban–rural status in this age group.

1.2. Contemporary Epidemiology

Melanoma mortality in the U.S. continued its upward climb through the early 2010s, then began leveling off temporally coinciding with immune-checkpoint treatments entering standard practice around 2015–2018 [5]. From a clinical standpoint, non-melanoma skin cancer deaths follow a different trajectory; they've increased steadily, especially across Sunbelt regions [8]. This divergent pattern may reflect differential treatment efficacy for different cancer types. Most countries worldwide report increase in melanoma incidence, though several developed nations now report modest decreases in death rates [7]. Earlier detection and better treatment options may explain this shift. Keratinocyte cancers haven't demonstrated similar improvements [8]. CDC WONDER mortality data provides one accessible way to monitor these trends over time [9].

1.3. Biological and Care-Delivery Considerations

Decades of sun exposure cause extensive somatic mutations in sun-damaged skin [10]. Aging brings less effective immune surveillance and abnormal growth regulation; some individuals may experience immunosuppression [11]. Clinical evidence demonstrates that physical limitations in older adults often lead to melanoma presentations that average 0.7 mm thicker than those found in middle-aged patients [12]. While checkpoint inhibitors may be effective in healthy elderly patients, treatment adherence may be compromised by early discontinuation or treatment refusal due to patient concerns [13]. These biological and care-delivery factors may differentially influence melanoma and keratinocyte cancer mortality in late life, reinforcing the need to report combined and stratified trends.

1.4. Persistent Disparities

Non-Hispanic White patients represent most skin cancer cases, yet Black, Hispanic, Asian and American Indian adults experience worse survival rates. Cancer often gets diagnosed at advanced stages in these populations [14–16]. Rural residents face particularly significant barriers to care, with melanoma death rates running about one-third higher than urban areas, mainly due to specialist shortages and longer travel distances [17]. The skin cancer prevention campaign demonstrates unequal penetration across various demographic regions. The 2021 National Health Interview Survey data showed only one in six adults over 65 used sun protection consistently, while one in five reported recent sunburns [18]. Given rising mortality and persistent gaps by geography and race/ethnicity, quantifying subgroup trends in older adults is a public-health priority.

1.5. Knowledge Gaps and Study Aim

The 2014 Surgeon General's Call to Action made skin cancer prevention a federal priority [19]. Analysis of population-level data revealed a critical knowledge gap. Current research lacks comprehensive understanding of temporal associations between immunotherapy adoption and pandemic-related healthcare disruptions with mortality patterns. Most U.S. trend studies focus on melanoma alone or shorter time spans and seldom pair demographic, geographic, and urban–rural stratification in one analysis. Our study had dual objectives: (a) document long-term age-adjusted mortality trends and (b) quantify disparities across sex, race/ethnicity, urban-rural status, and geographic regions. We use MCODE data (1999–2023) to provide stable estimates for combined C43–C44 mortality in adults ≥ 65 . The findings of this investigation would help public-health officials target their prevention, screening, and treatment programs [9,20,21].

2. Materials and Methods

2.1. Study Design and Data Source

Our population-based retrospective study examined U.S. Multiple Cause-of-Death (MCOD) files spanning 1999 through 2023, accessed via CDC WONDER data in May 2024 [9]. The dataset contains de-identified death certificate information only, so institutional review board approval was not necessary. We followed CDC WONDER Data-Use Agreement requirements and adhered to STROBE reporting standards throughout our analysis [22].

2.2. Case Definition and Rationale

We used the MCODE query interface to select death certificates documenting malignant melanoma (ICD-10 C43.0–C43.9) and/or keratinocyte skin cancers (ICD-10 C44.0–C44.9) listed anywhere on the certificate. This dual approach captures total deaths from UV-linked skin cancer while maintaining consistency with national surveillance methods.

2.3. Study Population and Variables

NCHS coding systems [23] allowed stratification by age (adults ≥ 65 years), sex, bridged race/ethnicity, Census regions, and county-level urban–rural status. For race/ethnicity, we classified deaths into four mutually exclusive groups: non-Hispanic (NH) White, NH Black or African American, NH Others (non-Hispanic Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and other/unknown), and Hispanic or Latino. The NH Others category combined Asian, American Indian, Alaska Native, and other minority racial groups to improve rate stability for trend analysis. It should be noted that racial/ethnic misclassification on death certificates may affect accuracy, particularly for minority populations (with greater potential misclassification for American Indian/Alaska Native and Hispanic decedents).

Geographic analysis included the four U.S. Census regions (Northeast, Midwest, South, West) and county-level urban classifications. Urban–rural status was assigned using the 2013 NCHS six-level taxonomy, collapsed into metropolitan versus non-metropolitan categories. Counties that

transitioned to urban status after 2013 retained their original classification, introducing potential timing-related bias addressed in the limitations. Urbanization analyses were limited to 1999–2020 due to data availability for the 2013 NCHS scheme.

CDC WONDER suppressed all cells with fewer than 10 deaths to protect confidentiality. Single-year bridged-race population estimates were used as denominators; intercensal estimates were applied for earlier years and postcensal estimates for 2021–2023.

2.4. Data Management and Quality Control

We exported comma-separated output files to Microsoft Excel 365 and performed several quality verification steps. Initially, we cross-checked county FIPS codes against their Census regions. We confirmed that death counts based on bridged-race categories matched available population figures and verified our annual totals against WONDER system displays. These validation steps revealed no discrepancies.

2.5. Statistical Analysis

We calculated age-adjusted mortality rates (AAMR per 100,000) using the direct method with 2000 U.S. standard population weights [25,26]. NCHS recommendations guided our use of the γ -distribution approach for generating 95% confidence intervals [27]. We employed Joinpoint Regression Program version 5.4.0 from the National Cancer Institute for trend analysis [28]. Our analysis permitted up to four joinpoint, determined via Monte Carlo permutation testing with $\alpha = 0.05$ [29]. We assessed statistical significance through annual percent change calculations, with observed changes considered significant when confidence intervals excluded zero. Given the multiple comparisons across demographic subgroups, readers should interpret statistically significant results with appropriate caution.

3. Results

A total of 249,811 skin-cancer related deaths were recorded in the US between 1999 and 2023 among adults aged 65 and above.

3.1. Annual Trends for Skin Cancer-Related AAMR

According to joinpoint regression, the overall AAMR increased from 1999 to 2014 (APC: 1.12; 95% CI: 0.8–1.3), showed no significant change from 2014 to 2017 (APC: –2.9; 95% CI: –8.5–3.1), and increased again from 2017 to 2023 (APC: 2.4; 95% CI: 1.4–3.4). Year-specific AAMRs were 22.6 in 2019, 23.7 in 2020, and 25.8 in 2021 (series peak), remaining elevated through 2023. No new joinpoint appeared in 2020.

3.2. Skin Cancer-Related AAMR Stratified by Sex

Overall age-adjusted mortality rate for males was around three times higher than that of females (overall AAMR males: 37.4 vs females: 13.1). From 1999 to 2019, mortality among females showed no significant change (APC: 0.01, 95% CI: –0.2–0.2) after which it increased till 2023 (APC: 3.1, 95% CI: 0.8–5.4). For males, the trend demonstrated a steady rise, with rates highest in 2014 (APC: 1.3, 95% CI: 0.9–1.6), no significant change from 2014 to 2017 (APC: –3.4, 95% CI: –9.8–3.5) and an increase thereafter to the end of the study period (APC: 2.0, 95% CI: 1.0–3.1). The male-female AAMR gap persisted across all years.

3.3. Skin Cancer-Related AAMR Stratified by Race/Ethnicity

Racial and ethnic disparities in skin cancer mortality were substantial over the study period. In the most recent year of data (2023), age-adjusted mortality rates (AAMRs) were highest among non-Hispanic (NH) White individuals at 31.6 per 100,000, followed by Hispanic or Latino (7.9), NH Black

or African American (4.5), and NH Others which includes Asian, American Indian, Alaska Native, and other minority groups at 3.9 per 100,000. Among NH White individuals, mortality increased from 1999 to 2014 (APC: 1.52; 95% CI: 1.24 to 1.80), showed no significant change in 2014–2017 (APC: –2.42; 95% CI: –8.22 to 3.74), and increased in 2017–2023 (APC: 2.94; 95% CI: 1.95 to 3.94). For NH Black or African American individuals, rates declined in 1999–2017 (APC: –1.79; 95% CI: –2.48 to –1.09) and showed no significant change in 2017–2023 (APC: 1.66; 95% CI: –1.59 to 5.01). Hispanic or Latino populations were stable across the entire period (APC: 0.27; 95% CI: –0.14 to 0.68). NH Others declined modestly overall (APC: –0.80; 95% CI: –1.43 to –0.16). These patterns are illustrated in Figure 1 and detailed in Supplementary Tables 2 and 5 (Figure S2). Rates for smaller racial groups should be interpreted with caution due to potential misclassification and sparse counts.

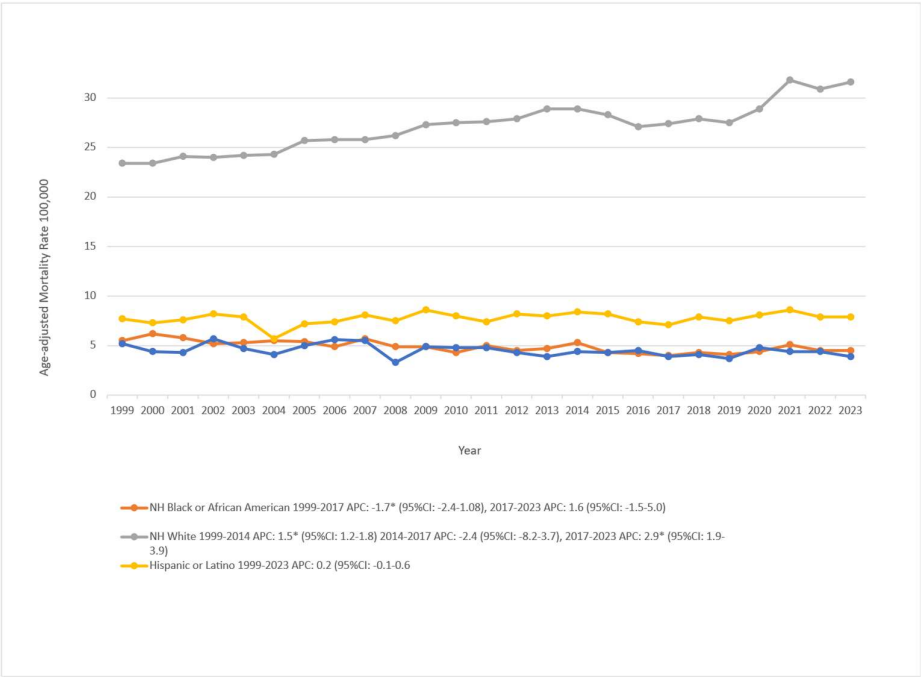


Figure 1. Skin cancer-related AAMR stratified by race/ethnicity in U.S. adults aged ≥ 65 years, 1999–2023.

3.4. Skin Cancer-Related AAMR Stratified by Geographic Region

Mortality rates varied by region, with the West highest (overall AAMR: 24.2 per 100,000), followed by the South (23.3), Midwest (22.2), and Northeast (21.6). In terms of trends, the Midwest showed a continuous increase across 1999–2023 (APC: 0.80; 95% CI: 0.56–1.01). The Northeast, South, and West each increased in the early period (Northeast and South 1999–2014; West 1999–2013), showed no significant change in 2014–2017, and increased in 2017–2023 for the South and West, while the Northeast showed no significant change in 2017–2023. No region showed an additional joinpoint in 2020. See Figure 2; Supplementary Tables S3 and S7; Supplementary Figure S3.

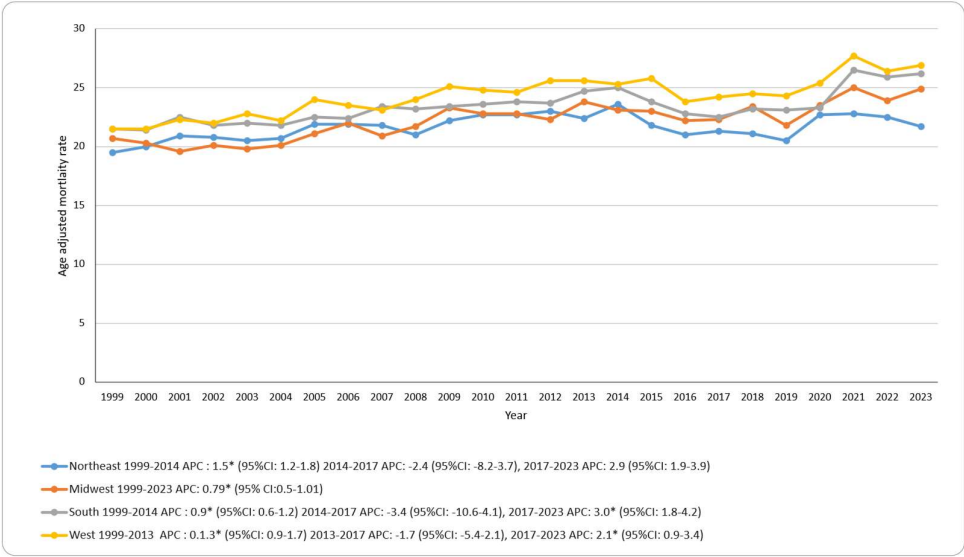


Figure 2. Skin cancer-related AAMR stratified by geographic region in U.S. adults aged ≥ 65 years, 1999-2023.

Urbanization (2013 scheme, 1999–2020): Nonmetropolitan counties had a higher AAMR than metropolitan counties (25.0 vs 22.2 per 100,000). Nonmetropolitan counties showed a steady increase (APC: 0.96; 95% CI: 0.72–1.2). For metropolitan counties, AAMR increased to 2014, showed no significant change from 2014 to 2017, and no significant change from 2017 to 2020 (APC: 1.44; 95% CI: –0.28 to 3.19). Because urbanization data are available only through 2020, trends are reported through 2020. The results are presented in Figure 3; Supplementary Tables S8; Figure S4.

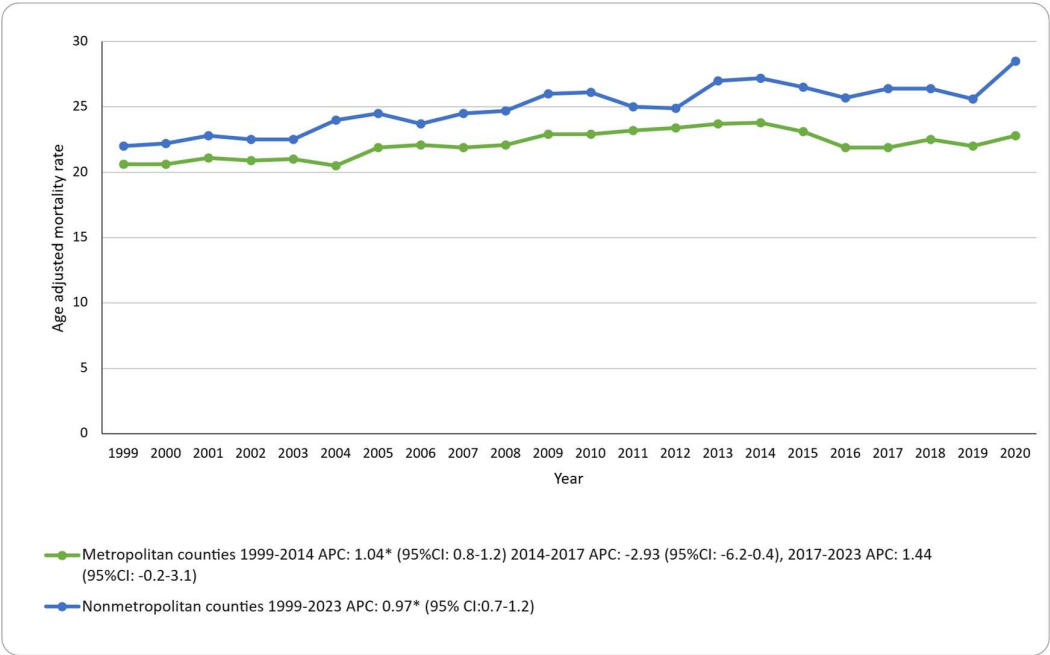


Figure 3. Skin cancer-related AAMR stratified by Urbanization (metropolitan vs non-metropolitan counties) in U.S. adults aged ≥ 65 years, 1999-2020.

4. Discussion

Our research shows that skin-cancer mortality rates among Americans aged ≥ 65 have started rising again. The mortality rates showed a $\sim 1\%$ yearly increase from 1999 to 2014, followed by a temporary, non-significant change during 2014–2017 that coincided with early uptake of immune checkpoint inhibitors, before peaking in 2021 and remaining elevated through 2023 [5]. Several high-income nations show similar patterns where incidence outpaces survival gains [7]. Healthcare professionals should examine the underlying factors associated with this resurgence. Multiple elements may be contributing to this increase. The aging population experiences rising keratinocyte cancer rates [8] and elderly patients face challenges with intensive systemic treatment due to frailty and prolonged UV exposure. Particularly concerning is the persistent rural–urban divide. The AAMR in rural counties exceeded that of urban areas by 12.6% (≈ 2.8 per 100,000) throughout 1999–2020. The persistent gap suggests access-to-care problems in rural regions because of distant dermatologists and specialist shortages [30]. The enduring nature of this difference indicates that underserved areas require specific screening and early-treatment programs. For context only, we interpret joinpoint-derived segments as three descriptive eras; 1999–2014 increase; 2015–2017 temporary decline; 2017–2023 renewed increase, with no breakpoint in 2020 and no causal attribution implied.

4.1. Placing Our Findings in Broader Context

The mortality rates have increased significantly with substantial differences between male and female populations (37.4 vs 13.1 per 100,000) and between the Western and Northeastern regions (24.2 vs 21.6 per 100,000). Non-Hispanic Whites bear the highest burden of skin cancer deaths. When we compare our findings internationally, the United States ranks its senior mortality rates between Canada and Australia and New Zealand regarding melanoma-specific deaths [31]. The late life death rates of Australian and New Zealand seniors remain elevated despite prevention efforts that have been implemented for years [32]. However, international comparison is challenging because of different coding practices and healthcare access and population demographics across countries. In addition, most international figures are melanoma-specific; our outcome combines C43 and C44, so cross-country ranking should be interpreted cautiously. These sex and regional contrasts persisted across the study period.

4.2. Understanding Demographic and Geographic Disparities

The mortality burden among racial and ethnic groups remained uneven throughout the study period. Non-Hispanic (NH) White individuals experienced the highest mortality at 31.6 per 100,000 in 2023, followed by Hispanic or Latino (7.9 per 100,000), NH Black or African American (4.5 per 100,000), and NH Others, which includes Asian, American Indian, Alaska Native, and other minority groups at 3.9 per 100,000. Rates are age-adjusted, so these differences are unlikely to reflect age structure alone. NH Others aggregates multiple groups to stabilize estimates; small counts and potential race/ethnicity misclassification widen uncertainty and warrant cautious interpretation. Trend analysis showed that NH White mortality rose in 1999–2014, dipped slightly in 2014–2017, and increased again from 2017 onward, reaching the highest recorded rate in 2023. NH Black rates declined steadily from 1999 to 2017 before leveling off, while Hispanic and NH Others groups remained relatively stable; NH Others had a modest but statistically significant long-term decline.

The differences reflect a combination of behavioral, structural, and healthcare access factors. The elevated mortality in NH White populations likely stems from cumulative lifetime UV exposure, high prevalence of fair skin phenotypes, and historically higher melanoma incidence. In Hispanic or Latino populations, outdoor occupational exposure, language barriers, and delays in seeking diagnostic care may contribute to intermediate mortality levels [33]. The relatively lower but persistent mortality in NH Black or African American groups may be explained by lower melanoma incidence but greater late-stage diagnoses when lesions occur, compounded by limited access to specialized dermatologic care in some communities. The low rates among NH Others mask within-group variation; American Indian and Alaska Native adults, for example, often face substantial care shortages in tribal and rural areas [34].

Geographic and structural factors amplify these disparities. Rural residents, regardless of race or ethnicity, travel longer distances for dermatology services, and in many areas, specialist shortages remain chronic. Broadband limitations further hinder the reach of teledermatology services, particularly in non-metropolitan counties [30]. These are mortality patterns, not incidence or case-fatality; mechanisms may differ between melanoma and keratinocyte cancers, underscoring the need for cause-specific analyses in future work.

4.3. Year Specific Patterns, 2019–2023

The AAMR increased from 22.6 per 100,000 in 2019 to 25.8 in 2021 and remained elevated through 2023. Joinpoint analysis detected no new breakpoint in 2020, indicating that the upward trend was already underway before the pandemic. During this period, U.S. healthcare services experienced substantial disruption: initial lockdowns were associated with biopsy volumes dropping by up to 50% [41], oncology capacity was redirected, potentially delaying checkpoint inhibitor treatment for some older adults [42], and teledermatology expansion failed to reach many rural and low-income counties with higher baseline mortality [30]. Outside the United States, a five-center cohort from Austria, Germany, and Italy reported thicker melanomas in 2021 compared with pre-pandemic lesions [43], whereas a nationwide Dutch audit found little evidence of stage shift despite similar service disruptions [44]. Linking U.S. registry staging data with claims-based treatment timelines will be important to clarify whether the post-2019 mortality increase reflects disease progression, diagnostic delays, or other mechanisms.

4.4. Implications for Practice and Policy

Research has consistently shown that men aged ≥ 65 along with several minority communities including American Indian and Alaska Native elders lack risk awareness [34]. Pandemic-era reviews show that diagnostic delays are associated with thicker tumors and, ultimately, poorer outcomes [42,45]. This makes timely, culturally tailored messaging important. From a public health standpoint, multilingual community-based campaigns delivered through trusted channels such as Medicare newsletters, veterans' clinics, and county extension meetings may help address this awareness gap. Workforce shortages may respond to targeted incentives. The success of loan-forgiveness programs has led clinicians to practice in underserved areas in other medical specialties [46]. A skin-cancer specific loan forgiveness option could be piloted in Western and Southern counties where mortality exceeds ~ 24 per 100,000. Mobile dermatology units using broadband teleconsultation services may help reduce the travel challenges that rural patients face. Implementation should include simple evaluation metrics (e.g., time to biopsy, time to excision, rural teledermatology uptake).

4.5. Strengths and Limitations

Our study brings several important strengths to the literature. The analysis of 25 years of death certificate data enabled us to generate reliable statistics for sex, race/ethnicity, region, and urbanicity. The long observation window provides broad temporal coverage across major changes in cancer care and service delivery. Our comparisons and trend detection were made robust through age standardization to the 2000 U.S. population and joinpoint regression.

However, we acknowledge several important limitations. The combination of melanoma (C43) and keratinocyte cancers (C44) into a single outcome likely obscures disease-specific patterns. This combination means that the survival of melanoma patients may be influenced by therapeutic progress, while the mortality of keratinocyte cancer patients may be more affected by delays in diagnosis. The rural–urban classifications were fixed at 2013 boundaries; by 2020, perhaps one-fifth of rural counties had transitioned to metropolitan, likely leading us to underestimate current disparities. Death certificates do not capture stage, treatment, or comorbidity information and can misclassify race/ethnicity, particularly for American Indian and Hispanic decedents, which may widen uncertainty around subgroup estimates. We did not apply multiple-comparison corrections in

this descriptive analysis, which may have increased the risk of Type I error in subgroup analyses. These limitations may bias absolute rates downward, and compress observed gaps. Eras were not pre-specified; joinpoint segments were related to eras post hoc for context and should be interpreted descriptively, not causally.

4.6. Future Directions

Several research priorities emerge from our findings. The analysis of death certificates together with state cancer registry staging data and Medicare or commercial claims will help determine whether the deaths after 2017 show changes in keratinocyte cancer mortality, melanoma mortality, or both. Future work should report cause-specific trends (C43 vs C44) and incorporate standardized stage and treatment linkages. The analysis of county-level deprivation indices and dynamic rurality measures would help to explain how socioeconomic disparities may affect risk. Time-series models that consider autocorrelation might enhance breakpoint detection beyond what standard joinpoint methods offer. Predefined sensitivity analyses (e.g., alternative urbanicity definitions; exclusion of small-count strata) would strengthen robustness. Most importantly, there is a need for prospective cohort studies to monitor how delays in diagnosis during the pandemic era have affected staging and survival outcomes.

5. Conclusions

Skin-cancer mortality in Americans ≥ 65 remained elevated through 2023, peaking in 2021. While recent therapeutic advances have been developed, population-level evidence that immune-checkpoint inhibitors reduce mortality in this age group has not been definitively demonstrated. The factors underlying disproportionate impact on men, non-Hispanic White individuals, rural residents, and those living in Western states remain to be clarified. Based on our findings, a comprehensive approach may involve incorporating regular full-body skin checks into primary care, implementing same-day biopsy pathways, providing mobile and teledermatology services in underserved regions, and developing data systems that connect death certificates with registries and claims. Combining clinical initiatives with pragmatic public-health strategies and linked data systems may help reduce mortality in this growing population.

Author Contributions: MAM, EA and AK conceived this study. EA and SQ designed the study. AK abstracted the data and performed all statistical analyses. EA, SQ and AK generated the figures. EA, SQ, AK, and MAM drafted the manuscript and prepared successive revisions. AO supervised the project, provided critical reviews, and managed the administration. All the authors have read and approved the final manuscript.

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Institutional Review Board Statement: Ethical review and approval were waived for this study as we used publicly available de-identified mortality data from the CDC WONDER database. No individual consent was required because the study used aggregate, deidentified data. The data were treated and analyzed in accordance with the CDC WONDER Data Use Agreement and analytic guidelines.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data is publicly available at <https://wonder.cdc.gov/>.

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The graphical abstract was created in BioRender. Atif, E. (2025) <https://BioRender.com/lw96c9i>

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

AAMR	Age-adjusted mortality rate
APC	Annual percent change
CDC	Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic
WONDER	Research
CI	Confidence Interval
CDC	Centers for Disease Control and Prevention
ICD-10	International Classification of Diseases, Tenth Revision
NCHS	National Center for Health Statistics
UV	Ultraviolet radiation

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